

## ADDENDUM TO CONTRACT DOCUMENTS

**Project:** Tigard Senior Center  
8815 SW O'Mara Street  
Tigard, Oregon 97223

**Owner:** City of Tigard  
13125 SW Hall Blvd.  
Tigard, Oregon 97223

**To:** Plan Holders

**Architect:** LRS Architects, Inc.  
720 NW Davis Street, Suite 300  
Portland, OR 97209

**Project No.** 207037

**Date:** September 20, 2007

**Addendum No:** 1

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This Addendum forms a part of the Contract Documents and modifies the original Bidding Documents dated September 17, 2007. Acknowledge receipt of this Addendum in the space provided on the Bid Form. Failure to do so may subject the Bidder to disqualification.

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### PROJECT MANUAL

#### 1.1 Invitation to Bid

**Replace:** Invitation to Bid pages 1 - 10

#### 1.2 Document 00 0110: Table of Contents

**Replace:** Document 00 0110: Table of Contents, page 3 and 4.

#### 1.3 Project Specifications

**Add:** New Section 21 0500: Common Work Results for Fire Suppression, per attachment.

**Add:** New Section 21 1300: Fire-Suppression Sprinkler System, per attachment.

**Add:** New Section 22 0050: Basic Plumbing Materials and Methods, per attachment.

**Add:** New Section 22 0553: Identification for Plumbing Piping and Equipment, per attachment.

**Add:** New Section 22 0719: Plumbing Piping Insulation, per attachment.

**Add:** New Section 22 1005: Plumbing Piping, per attachment.

**Add:** New Section 22 1006: Plumbing Piping Specialties, per attachment.

**Add:** New Section 22 3000: Plumbing Equipment, per attachment.

**Add:** New Section 22 4000: Plumbing Fixtures, per attachment.

**Add:** New Section 23 0050: Basic Mechanical Materials and Methods, per attachment.

**Add:** New Section 23 0548: Vibration and Seismic Controls for HVAC Piping and Equipment, per attachment.

**Add:** New Section 23 0593: Testing, Adjusting, and Balancing for HVAC, per attachment.

**Add:** New Section 23 0713: Duct Insulation, per attachment.

**Add:** New Section 23 2300: Refrigerant Piping, per attachment.

**Add:** New Section 23 3100: HVAC Ducts and Casings, per attachment.

**Add:** New Section 23 3300: Air Duct Accessories, per attachment.

**Add:** New Section 23 3423: HVAC Power Ventilators, per attachment.

**Add:** New Section 23 3700: Air Outlets and Inlets, per attachment.

**Add:** New Section 23 4000: HVAC Air Cleaning Devices, per attachment.

**Add:** New Section 23 5400: Split System Heating and Cooling, per attachment.





**Add:** New Section 28 3100: Fire Alarm System, per attachment.

## **DRAWINGS**

### **1.4 Project Drawings**

**Add:** New Drawing M0 dated 9-20-07, per attachment.  
**Add:** New Drawing M1.0 dated 9-20-07, per attachment.  
**Add:** New Drawing M2.0Db dated 9-20-07, per attachment.  
**Add:** New Drawing M2.0b dated 9-20-07, per attachment.  
**Add:** New Drawing M2.1Db dated 9-20-07, per attachment.  
**Add:** New Drawing M2.1a dated 9-20-07, per attachment.  
**Add:** New Drawing M2.1b dated 9-20-07, per attachment.  
**Add:** New Drawing PL0 dated 9-20-07, per attachment.  
**Add:** New Drawing PL1.0 dated 9-20-07, per attachment.  
**Add:** New Drawing PL2.00Db dated 9-20-07, per attachment.  
**Add:** New Drawing PL2.00b dated 9-20-07, per attachment.  
**Add:** New Drawing PL2.0Da dated 9-20-07, per attachment.  
**Add:** New Drawing PL2.0Db dated 9-20-07, per attachment.  
**Add:** New Drawing PL2.0a dated 9-20-07, per attachment.  
**Add:** New Drawing PL2.0b dated 9-20-07, per attachment.  
**Add:** New Drawing PL2.1Da dated 9-20-07, per attachment.  
**Add:** New Drawing PL2.1Db dated 9-20-07, per attachment.  
**Add:** New Drawing PL2.1a dated 9-20-07, per attachment.  
**Add:** New Drawing PL2.1b dated 9-20-07, per attachment.  
**Add:** New Drawing PL3.0Da dated 9-20-07, per attachment.  
**Add:** New Drawing PL3.0Db dated 9-20-07, per attachment.  
**Add:** New Drawing PL3.0a dated 9-20-07, per attachment.  
**Add:** New Drawing PL3.0b dated 9-20-07, per attachment.  
**Add:** New Drawing PL3.1Da dated 9-20-07, per attachment.  
**Add:** New Drawing PL3.1Db dated 9-20-07, per attachment.  
**Add:** New Drawing PL3.1a dated 9-20-07, per attachment.  
**Add:** New Drawing PL3.1b dated 9-20-07, per attachment.  
**Add:** New Drawing PL4.0 dated 9-20-07, per attachment.  
**Add:** New Drawing FP1.0 dated 9-20-07, per attachment.

## **ATTACHMENTS**

### **Specifications:**

Section 00 0110: Table of Contents; Page 3 and 4.  
Section 21 0500: Common Work Results for Fire Suppression  
Section 21 1300: Fire-Suppression Sprinkler System  
Section 22 0050 Basic Plumbing Materials and Methods  
Section 22 0553 Identification for Plumbing Piping and Equipment  
Section 22 0719 Plumbing Piping Insulation  
Section 22 1005 Plumbing Piping  
Section 22 1006 Plumbing Piping Specialties  
Section 22 3000 Plumbing Equipment  
Section 22 4000 Plumbing Fixtures  
Section 23 0050 Basic Mechanical Materials and Methods



Section 23 0548 Vibration and Seismic Controls for HVAC Piping and Equipment  
Section 23 0593 Testing, Adjusting, and Balancing for HVAC  
Section 23 0713 Duct Insulation  
Section 23 2300 Refrigerant Piping  
Section 23 3100 HVAC Ducts and Casings  
Section 23 3300 Air Duct Accessories  
Section 23 3423 HVAC Power Ventilators  
Section 23 3700 Air Outlets and Inlets  
Section 23 4000 HVAC Air Cleaning Devices  
Section 23 5400 Split System Heating and Cooling  
Section 28 3100 Fire Alarm System

Drawings: Full Size.

FP1.0	M0	M1.0	M2.0Db	M2.0b	M2.1Db	M2.1a	M2.1b
PL0	PL1.0	PL2.00Db	PL2.00b	PL2.0Da	PL2.0Db	PL2.0a	PL2.0b
PL2.1Da	PL2.1Db	PL2.1a	PL2.1b	PL3.0Da	PL3.0Db	PL3.0a	PL3.0b
PL3.1Da	PL3.1Db	PL3.1a	PL3.1b	PL4.0			

END OF ADDENDUM NO. 1





## CITY OF TIGARD, OREGON

### INVITATION TO BID

#### TIGARD SENIOR CENTER RENOVATION AND ADDITION

**DATE DUE:** Tuesday, October 9, 2007  
**TIME DUE:** 2:00 PM

Envelopes must be sealed and marked with ITB Title.  
Bidders must submit one (1) original and three (3) copies of their Bid.

If a bid exceeds \$100,000, Respondents must submit a First Tier Subcontractor Disclosure Form to the City no later than 4:00 PM, Tuesday, ~~October 9, 2007~~ **October 16, 2007**

A mandatory pre-bid walkthroughs/meetings will be held at 2:00 PM, Thursday, September 27, 2007 **and 2:00 PM Tuesday October 2, 2007** meetings at the City of Tigard Senior Center Building located at 8815 SW O' Mara, Tigard, Oregon 97223. **Potential bidders must attend one of the two meetings.**

PROJECT MANAGER:	ITB QUESTIONS:
Daniel Plaza, Parks and Facilities Manager City of Tigard, Public Works Phone: (503) 718-2590 Fax: (503) 684-7297 Email: <a href="mailto:daniel@tigard-or.gov">daniel@tigard-or.gov</a>	Joe Barrett, Buyer City of Tigard, Financial & Information Services Phone: (503) 718-2477 Fax: (503) 684-7297 Email: <a href="mailto:joseph@tigard-or.gov">joseph@tigard-or.gov</a>

**SUBMIT BIDS TO:**  
Joe Barrett, Buyer  
City of Tigard – Information Desk  
13125 SW Hall Blvd.  
Tigard, Oregon 97223





**PUBLIC NOTICE  
INVITATION TO BID  
TIGARD SENIOR CENTER  
RENOVATION AND ADDITION**

The City of Tigard is requesting sealed bids from firms qualified to provide an construction services to the City for facility upgrades to Tigard's Senior Center. Firms are invited to submit a sealed bid for the requested services as outlined in the City's Invitation to Bid packet. A mandatory pre-bid walkthrough and meeting will be held at 2:00 PM Pacific Daylight Time (PDT), Thursday, September 27, 2007 **and the same time Tuesday October 2, 2007** at the City of Tigard Senior Center located at 8815 SW O' Mara Street, Tigard, Oregon 97223. Any firm wishing to bid on the project must be represented at **one of the** pre-bid walkthrough or their bid will be deemed nonresponsive.

Sealed bids will be received by Joe Barrett, Buyer at Tigard City Hall's Information Desk located at 13125 SW Hall Blvd., Tigard, Oregon 97223 no later than 2:00 PM PST on Tuesday, ~~October 9, 2007~~ **October 16, 2007** with public opening to immediately follow. If a bid is submitted for an amount exceeding \$100,000, the Bidder shall submit a First Tier Subcontractor Disclosure Form included in the Bid Packet to the City no later than 4:00 PM PST on Tuesday, ~~October 9, 2007~~ **October 16, 2007** to the attention of Joe Barrett, Buyer, at the Tigard City Hall Information Desk. A ten percent bid security must accompany a firm's bid.

Facsimile and electronic (email) bids will not be accepted. Bids will not be accepted after the stated opening date and time and late bids will be returned to the vendor unopened. The City intends to enter into a contract with the successful Bidder to provide the required services.

Bid packets may be downloaded from <http://www.tigard-or.gov>, obtained from ~~Precision Images by calling (503) 274-2030~~, **Department of Public Works at 8777 SW Burnham St.** or by calling Joe Barrett, Buyer at (503) 718-2477 **or Daniel Plaza, Project Manager at (503) 718-2590**. Bids must be submitted on the bid form provided in the bid package.

No bid will be received or considered by the City unless the bid contains, or is accompanied by, a statement that the provisions contained in ORS 279C.840 and ORS 279C.845 pertaining to prevailing wages shall be met. All bidders are required to certify that they have (or will have) a drug-testing program in place at the time of execution of a contract with the successful bidder and will continue the program for the duration of the contract.

The City may reject any bid not in compliance with all prescribed public bidding procedures and requirements, and may reject for good cause any or all bids upon a finding of the City if it is in the public interest to do so.

Published: Daily Journal of Commerce  
Date: September 18, 2007  
Published: The Oregonian  
Date: September 18, 2007



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## **SECTION 1**

### **INTRODUCTION**

The City of Tigard is requesting sealed bids from firms qualified to provide construction services to the City for facility upgrades to Tigard's Senior Center. Firms are invited to submit a sealed bid for the requested services as outlined in the City's Invitation to Bid packet. A mandatory pre-bid walkthrough and meeting will be held at 2:00 PM Pacific Daylight Time (PDT), Thursday, September 27, 2007 **and the same time Tuesday October 2, 2007** at the City of Tigard Senior Center located at 8815 SW O' Mara Street, Tigard, Oregon 97223. Any firm wishing to bid on the project must be represented at **one of the** pre-bid walkthrough or their bid will be deemed nonresponsive.

Sealed bids will be received by Joe Barrett, Buyer at Tigard City Hall's Information Desk located at 13125 SW Hall Blvd., Tigard, Oregon 97223 no later than 2:00 PM PST on Tuesday, ~~October 9, 2007~~ **October 16, 2007** with public opening to immediately follow. If a bid is submitted for an amount exceeding \$100,000, the Bidder shall submit a First Tier Subcontractor Disclosure Form included in the Bid Packet to the City no later than 4:00 PM PST on Tuesday, ~~October 9, 2007~~ **October 16, 2007** to the attention of Joe Barrett, Buyer, at the Tigard City Hall Information Desk. A ten percent bid security must accompany a firm's bid.

Facsimile and electronic (email) bids will not be accepted. Bids will not be accepted after the stated opening date and time and late bids will be returned to the vendor unopened. The City intends to enter into a contract with the successful Bidder to provide the required services.

No bid will be received or considered by the City unless the bid contains, or is accompanied by, a statement that the provisions contained in ORS 279C.840 and ORS 279C.845 pertaining to prevailing wages shall be met. All bidders are required to certify that they have (or will have) a drug-testing program in place at the time of execution of a contract with the successful bidder and will continue the program for the duration of the contract.

The City may reject any bid not in compliance with all prescribed public bidding procedures and requirements, and may reject for good cause any or all bids upon a finding of the City if it is in the public interest to do so.

## **SECTION 2**

### **BID PREPARATION**

#### **1. EXECUTION OF BID**

Bids must be typewritten or prepared in ink. Bids shall be submitted on the "Bid Form" furnished by the City and must be signed in ink by an authorized representative of the bidder.

#### **2. CONFORMANCE TO BID REQUIREMENTS**

Bids must conform to the requirements of the Invitation to bid, which are hereby made a part of this contract. All requested attachments (references, descriptive literature, etc.) must be submitted with the bid and in the required format. Bid prices must be for the unit indicated on the bid. Failure to comply with all requirements may result in bid rejection.

#### **3. BID MODIFICATION**

Modifications or erasures made before bid submission must be initialed in ink by the person the person signing the bid. Bids once submitted may be modified in writing before the time and date set for bid closing. Any modifications shall be prepared on company letterhead, signed by an authorized representative, and state that the new document supersedes or modifies the prior bid. Modification must be submitted in a sealed envelope clearly marked "Bid Modification" and identify the bid and closing date. Bidders may not modify bids after bid closing time.



4. **BID WITHDRAWALS**

Bids may be withdrawn in writing on company letterhead signed by an authorized representative and received by the Purchasing Division or in person upon presentation of appropriate identification prior to bid closing time. Unopened bids withdrawn may be released to the bidder after voiding any date and time stamp used. Requests to withdraw mailed bids shall be marked "Bid Withdrawal" and shall clearly state bid title.

5. **PROTEST OF SPECIFICATIONS OR TERMS**

A bidder who believes any specifications or terms detailed in the bid packet or sample contract (Attachment E) are unnecessarily restrictive or limit competition may submit a protest in writing, to the Purchasing Office. A protest may be submitted via facsimile. Any such protest shall include the reasons for the protest and shall detail any proposed changes to the specifications or terms. The Purchasing Office shall respond to any protest and, if necessary, shall issue any appropriate revisions, substitutions, or clarification via addenda to all interested Bidders.

To be considered, protests must be received at least five- (5) days before the bid closing date. The City shall not consider any protest against award due to the content of bid specifications or contract terms submitted after the established protest deadline. All protests should be directed to Joe Barrett, Buyer and be marked as follows:

**ITB Specification/Term Protest**

Bid Name and Closing Date

City of Tigard

Attn: Joe Barrett, Buyer

13125 SW Hall Blvd.

Tigard, Oregon 97223

If a bid protest is received in accordance with section above, the bid opening date may be extended if necessary to allow consideration of the protest and issuance of any necessary addenda to the bid documents.

6. **ADDENDUM**

The City may modify the ITB by issuance of an "Addendum" to all prospective bidders within a reasonable time prior to bid closing to allow bidders to consider them in preparing their bids, but in no case less than 72 hours before the bid closing. If an Addendum is necessary after that time, the City, at its discretion, can extend the closing date.

Any Addendum issued, as a result of any change in the RFP, must be acknowledged by submitting the "Acknowledgment of Addendum" (Attachment B) with a proposal. Only questions that are answered by formal written addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7. **RECYCLABLE PRODUCTS**

Bidders shall use recyclable products to the maximum extent economically feasible in the performance of the contract set forth in this document.

8. **CITY'S PROJECT MANAGER**

The City's Project Manager for this work will be *Daniel Plaza, Parks and Facilities Manager*, who can be reached by phone at (503) 718-2590 or by email at [daniel@tigard-or.gov](mailto:daniel@tigard-or.gov).





**SECTION 3**  
**BID SUBMISSION AND OPENING**

**1. SUBMISSION**

One (1) original and three (3) copies of the sealed Bid must be received before the stated closing time at the address listed below. To assure that your bid receives priority treatment, please mark as follows.

**Tigard Senior Center**  
**Renovation and Addition**  
Due: October 9, 2007  
City of Tigard – Information Desk  
Attn: Joe Barrett, Buyer  
13125 SW Hall Blvd.  
Tigard, Oregon 97223

Bidders shall include their firm name and address on the outside of the envelope. It is the bidder's responsibility to ensure that bids are received prior to the stated closing time. The City shall not be responsible for the proper identification and handling of any bids submitted incorrectly. Late bids, late modification, or late withdrawals will not be accepted after the stated bid opening date and time and will be returned unopened. Facsimile and electronic (email) bids will not be accepted.

**2. BID OPENING**

Bids will be opened 2:00 PM on Tuesday, ~~October 9, 2007~~ **October 16, 2007** in the Tigard City Hall's Conference Room **to be determined**. Bidders may be present; however, award decisions will not be made at the opening.

**3. FIRST TIER SUBCONTRACTOR DISCLOSURE**

If a bid exceeds \$100,000, Bidders must submit a First Tier Subcontractor Disclosure Form, provided in this packet at Exhibit D, to the City no later than 4:00 PM, Tuesday, October 9, 2007.

**4. BID SECURITY**

Pursuant to Tigard Public Contracting Rule 30.055, all bidders must submit a bid security to the City along with their bid in an amount equal to ten percent (10%) of their base bid. The bid must be in one of the following forms:

- A. Surety bond from surety company authorized to do business in the State of Oregon; or
- B. Cashier's check, certified check, or savings and loan secured check.

A Bidders bid security shall be forfeited if the Bidder fails to execute the contract promptly and properly if so awarded. The bid security of all unsuccessful bidders shall be returned after a contract has been executed or all bids have been rejected.

**SECTION 4**  
**GENERAL INFORMATION**

**1. DEFINITIONS**

For the purpose of these specifications, the following definitions shall apply:

- A. City shall mean City of Tigard;
- B. Contractor shall mean the lowest responsive and responsible bidder awarded the contract;



- C. **Contract or Contract Documents** the written agreement between the City and Contractor which includes the Purchase Order, Invitation to Bid, any Addenda issued, describing the work to be done and the obligations of the parties.

2. **CONTRACT**

After the award, the Contractor and the City will enter into a public improvement contract incorporating the terms and conditions of the ITB document and the bid response. **Vendors taking exception to any of the contract terms shall submit a protest or request for change in accordance with Section 2.5 "Protest of Specifications or Terms" or their exceptions will be deemed waived.**

3. **ANTICIPATED TERM OF CONTRACT**

The Contract period shall begin on or around ~~November 14, 2007~~ **November 7, 2007** and end on or around January 15, 2008 with Substantial Completion achieved by December 31, 2007. This timeframe may be revised slightly prior to contract execution. In accordance with Tigard Public Contracting Rules the total duration of the Contract may not exceed five (5) years.

4. **CONTRACT PRICING ADJUSTMENTS**

Prices shall remain firm through the initial term of the subsequent Contract, with the following exceptions:

- A. City shall be given immediate benefit of any price decreases.
- B. Contractor shall promptly notify the City of amount and effective date of any decreases.
- C. Any decrease shall apply to any work requested on or after the effective date of decrease.

The City may consider a price increase for any Contract extension if the increased pricing remains advantageous to the City. Pricing increases must be received at the City at least forty-five (45) days prior to any extension of the Contract. Contractor shall provide documentation for price increase; failure to provide sufficient documentation shall result in rejection of increases. The City reserves the right to accept or reject any increases. In case of errors in pricing, unit prices shall govern.

5. **BUSINESS TAX AND FEDERAL ID NO. REQUIRED**

The City of Tigard Business Tax is required from successful Bidder. Chapter 5.4 of the Tigard Municipal Code states any business doing business in the City of Tigard shall pay a City of Tigard Business Tax. No contracts shall be signed prior to the obtaining of the City of Tigard Business Tax. Upon award of proposal, contractor shall complete a Federal W-9, Request for Taxpayer Identification Number and Certification Form for the City.

6. **RESIDENT BIDDER**

ORS 279C.365(h) requires every bidder on a public improvement contract to indicate whether they are a resident bidder as defined in ORS 279A.120. A resident bidder means a bidder that has paid unemployment taxes or income taxes in this state during the 12 calendar months immediately preceding submission of the bid and has a business address in the State of Oregon. This City requires all Bidders, regardless of the form of the subsequent contract, to indicate if they are a resident bidder or not (see Attachment C.) As a public contracting agency, the City shall prefer goods or services that have been manufactured or produced in this state if price, fitness, availability and quality are otherwise equal.



8. **PUBLIC RECORDS**

All bid material submitted by bidder shall become the property of the City and is public record unless otherwise specified. A bid that contains any information that is considered trade secret under ORS 192.501(2) should be segregated and clearly identified as such. This information will be kept confidential and shall not be disclosed except in accordance with the Oregon Public Records Law, ORS 192. The above restrictions may not include cost or price information, which must be open to public inspection.

9. **BILLING REQUIREMENTS**

Invoices shall be sent to City of Tigard, Attn: Accounts Payable, 13125 SW Hall Blvd., Tigard, Oregon 97223. Payment terms shall be a net 30 following the date the invoice is received.

10. **TERMINATION OF CONTRACT**

Contract may be terminated by mutual consent of both parties or by the City at its discretion with a 30 days' written notice. The City may cancel an order for goods at any time with written notice to Contractor, stating the extent and effective date of termination. If the contract is so terminated, Contractor shall be paid in accordance with the terms of the contract for goods delivered and accepted to the date of termination which cannot be mitigated by resale as provided in the Uniform Commercial Code (ORS 72.7060).

11. **PREVAILING WAGE**

The provisions of ORS Chapters 279A and 279C and all other Oregon and Federal provisions pertaining to minimum salaries and wages shall be incorporated by reference as if fully set forth in any contract resulting from this Invitation to Bid. The successful bidder shall agree that the workmen in each trade or occupation required for the work to be done pursuant to the resulting contract, employed in the performance of the resulting contract, either by the successful bidder or any subcontractor or other person doing or contracting to do any part of the work contemplated by the Contractor shall be paid not less than the prevailing, minimum hourly rate of wage specified by the Commissioner of the Bureau of Labor, and attached hereto.

For contracts \$50,000 or greater, the Contractor shall pay a fee equal to one-tenth of one percent (.001) of the price of the contract. The fee shall be paid on or before the first progress payment or 60 days from the date work first began on the contract, whichever comes first. The fee is payable to the Bureau of Labor and Industries and shall be mailed or otherwise delivered to the Bureau at the following address:

Bureau of Labor and Industries  
Wage and Hours Division  
Prevailing Wage Unit  
800 NE Oregon Street, # 32  
Portland, Oregon 97232

Contractor shall provide proof to the City prior to the beginning of any of the work that the Contractor has filed a public works bond with a corporate surety in the amount of \$30,000 with the Construction Contractors Board as required under Oregon PWR law.



**SECTION 5**  
**BID EVALUATION AND AWARD**

**1. BID VALIDITY TIMEFRAME**

All bids submitted shall be valid and binding for **sixty (60) calendar days** from bid closing date, unless extended by mutual consent of all parties.

**2. EVALUATION CRITERIA**

Bids will be awarded based upon the evaluation criteria detailed in the Invitation to Bid. Ordinarily, bids will be evaluated to identify the “lowest responsive and responsible bidder” who has substantially complied with all requirements and specifications of the ITB and who can be expected to deliver promptly and perform reliably.

**3. RECIPROCAL PREFERENCE**

In determining the “lowest responsible bidder,” the City shall add a percent increase to each out-of-state bidder’s bid price which is equal to the percent given to local bidders in that bidder’s home state. This is pursuant to ORS 279A.120(2)(b).

**4. DELIVERY DELAYS**

Significant delays in delivery may be considered in determining award if early delivery is required.

**5. METHOD OF AWARD**

The City reserves the right to make the award by item, groups of items or entire bid, whichever is in the best interest of the City.

**6. ERRORS IN BIDS**

When an error(s) is made in extending total prices, the unit bid price will govern. Bidders are cautioned to recheck their bid for possible error(s). Error(s) discovered after opening cannot be corrected and the contractor will be required to perform if their bid is accepted.

**7. BID REJECTION**

The City may reject any bid not in compliance with all prescribed public bidding procedures and requirements and may reject for good cause any or all bids upon a finding of the City that it is in the public interest to do so.

**8. MINOR INFORMALITIES**

The City reserves the right to waive any and all minor informalities that may arise in relation to this bid process.

**SECTION 6**  
**SPECIAL BID INSTRUCTIONS**

**1. TIME TABLE**

Tuesday, September 18, 2007

Tuesday, October 9-16, 2007 at 2:00 PM

Tuesday, October 9-16, 2007 at 4:00 PM

Tuesday, ~~October 23~~ November 6, 2007

Wednesday, ~~October 24~~ November 7, 2007

Tuesday, January 15<sup>th</sup>, 2008

Public Notice & Invitation to Bid Release

ITB Closing Date & Time

1<sup>st</sup> Tier Subcontractor Disclosure Due

Award of Contract by Local Contract Review Board

Contract Commencement Date

~~Substantial~~ Final Completion





2. **REQUESTED INFORMATION**

Please include a cover letter which includes a brief corporate history, how long in business, number of employees, when registered to do business in Oregon, etc.

3. **BIDDERS QUALIFICATIONS AND REFERENCES**

All bidders must fully complete and submit the "Bidder Qualifications and Reference Form" on page 16-17 of this ITB. Bidders must include at least three (3) references will be considered for this project. Failure to provide complete the information may be cause for bid rejection.

4. **CONTRACTOR CONTACTS**

Contractor shall designate one (1) primary and one (1) backup person responsible for the contractor's work under this contract. Contractor shall provide to City the names, addresses and telephone numbers, including after hours/emergency numbers of such persons and shall keep this information current with the City Contract Administrator at all times.

5. **CONSORTIUMS / PARTNERSHIPS / SUBCONTRACTORS**

The City will not consider bids submitted by a consortium, or by multiple firms submitting as partners or joint ventures. Bidders shall not consider the use of sub-contractors for this bid proposal. Contractor must have sufficient resources to perform all services required by this contract. The City reserves the right to approve the use of sub-contractors during the term of this contract as special circumstances dictate.

6. **NON-COLLUSION AFFIDAVIT**

Bidder certifies that this bid/proposal has been arrived at independently and has been submitted without collusion designed to limit independent bidding or competition.

7. **BILLING METHOD**

Each invoice shall include adequate detail to identify each good or service purchased. At a minimum this detail shall include:

- A. Total number of man hours for the billing period;
- B. Detailed pricing and specification for any goods purchased;
- C. Details regarding the status of the project, i.e. completion percentage, revised estimated time of completion, etc.; and
- D. Payment due date.

8. **QUANTITIES**

The City does not bind itself to purchase the full quantities stipulated in the proposal as estimates. The quantities shown as estimates are not exact. They represent past purchasing activity and estimates of future usage and are given for comparing bids on a uniform basis. Payment shall be made only for quantities ordered, delivered and accepted, whether greater or less than the stated amounts. Quantities listed on proposal are based on a one-year estimate.

**SECTION 7**  
**DETAILED SPECIFICATIONS**

Work shall include, but shall not be limited to the following:

Tenant improvement renovations as indicated in the Drawings and as specified in the Project Manual.



**DIVISION 12 FURNISHINGS**

- 12 2113 Louver Blinds
- 12 4813 Entrance Floor Mats
- 12 9313 Bicycle Racks

**DIVISION 21 FIRE SUPPRESSION**

- 21 0500 Common Work Results for Fire Suppression
- 21 1300 Fire-Suppression Sprinkler System

**DIVISION 22 PLUMBING**

- 22 0050 Basic Plumbing Materials and Methods
- 22 0553 Identification for Plumbing Piping and Equipment
- 22 0719 Plumbing Piping Insulation
- 22 1005 Plumbing Piping
- 22 1006 Plumbing Piping Specialties
- 22 3000 Plumbing Equipment
- 22 4000 Plumbing Fixtures

**DIVISION 23 HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)**

- 23 0050 Basic Mechanical Materials and Methods
- 23 0548 Vibration and Seismic Controls for HVAC Piping and Equipment
- 23 0593 Testing, Adjusting, and Balancing for HVAC
- 23 0713 Duct Insulation
- 23 2300 Refrigerant Piping
- 23 3100 HVAC Ducts and Casings
- 23 3300 Air Duct Accessories
- 23 3423 HVAC Power Ventilators
- 23 3700 Air Outlets and Inlets
- 23 4000 HVAC Air Cleaning Devices
- 23 5400 Split System Heating and Cooling

**DIVISION 26 ELECTRICAL**

- 26 0500 Basic Electrical Materials and Methods
- 26 0519 Conductors and Connectors
- 26 0526 Grounding
- 26 0533 Conduits, Raceways, Boxes and Fittings
- 26 0553 Identification
- 26 2000 Secondary Distribution System
- 26 2726 Wiring Devices
- 26 2816 Disconnect Switches
- 26 5100 Interior Lighting

**DIVISION 27 COMMUNICATIONS**

- 27 0500 Common Work Results for Communications



**DIVISION 28 ELECTRONIC SAFETY AND SECURITY**

28 3100 Fire Alarm System

**DIVISION 31 EARTHWORK**

31 1000 Site Clearing

31 2000 Earth Moving

**DIVISION 32 EXTERIOR IMPROVEMENTS**

32 1216 Asphalt Paving

32 1313 Concrete Paving

**DIVISION 33 UTILITIES**

Not Used

END OF TABLE OF CONTENTS









## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

### 1.2 SECTION INCLUDES

- A. Pipe, fittings, valves, and connections for sprinkler systems.

### 1.3 RELATED SECTIONS

- A. Section 23 0050 - Basic Mechanical Materials and Methods.
- B. Section 21 1300 (13925) - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

### 1.4 REFERENCES

- A. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2004.
- B. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).
- C. ASME B16.9 - Factory-made Wrought Steel Buttwelding Fittings; The American Society of Mechanical Engineers; 2003.
- D. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2005.
- E. ASTM A 135 - Standard Specification for Electric-Resistance Welded Steel Pipe; 2005.
- F. ASTM A 795/A 795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2004.
- G. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association; 2005 (ANSI/AWWA C105/A21.5).
- H. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2007.
- I. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; National Fire Protection Association; 2007.
- J. UL 262 - Gate Valves for Fire-Protection Service; Underwriters Laboratories Inc.; 2004.
- K. UL 312 - Check Valves for Fire-Protection Service; Underwriters Laboratories Inc.; 2004.
- L. UL 1091 - Butterfly Valves for Fire-Protection Service; Underwriters Laboratories Inc; 2004.

### 1.5 SUBMITTALS

- A. See Section 23 0050 for submittal procedures.
- B. Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.
- C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections. Refer to Drawings for additional requirements.
- D. Project Record Documents: Record actual locations of components and tag numbering.
- E. Operation and Maintenance Data: Include installation instructions and spare parts lists.

## PART 2 PRODUCTS

### 2.1 GENERAL SYSTEM AND PRODUCT REQUIREMENTS

- A. Revise the existing system to coordinate with the additional and revised building layout.
- B. Sprinkler Systems: Conform work to NFPA 13.
- C. Welding Materials and Procedures: Conform to ASME Code.

### 2.2 ABOVE GROUND PIPING

- A. Galvanized Steel Pipe: ASTM A 795 Schedule 10, ASTM A 53 Schedule 40, or ASTM A 135 Schedule 10, galvanized.
  - 1. Steel Fittings: ASME B16.9, wrought steel, buttwelded, galvanized for exposed piping locations.
  - 2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings, galvanized for exposed piping locations.
  - 3. Malleable Iron Fittings: ASME B16.3, threaded fittings, galvanized for exposed piping locations.
  - 4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized.
  - 5. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring, uniformly compressed into permanent mechanical engagement onto pipe; galvanized.

### 2.3 GATE VALVES

- A. Over 2 inches:
  - 1. Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid rubber covered bronze or cast iron wedge, flanged ends.
  - 2. UL and FM listed.

### 2.4 BALL AND BUTTERFLY VALVES

- A. Up to and including 2-1/2 inches:
  - 1. Bronze body.
  - 2. Brass, chrome plated bronze, or stainless steel ball or butterfly.
  - 3. Teflon seats and stuffing box ring.
  - 4. Handwheel operation and integral indicating device.
  - 5. Grooved or threaded end connections.
  - 6. Built-in tamper switch rated 10 amp at 115 volt AC.
  - 7. UL and FM listed.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

### 3.2 INSTALLATION

- A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- B. Install piping to conserve building space, to not interfere with use of space and other work.
- C. Group piping whenever practical at common elevations.
- D. Sleeve pipes passing through partitions, walls, and floors.

- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Pipe Hangers and Supports:
  - 1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
  - 2. Place hangers within 12 inches of each horizontal elbow.
  - 3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - 4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
  - 5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- G. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- H. Do not penetrate building structural members unless indicated.
- I. Provide sleeves when penetrating footings, floors, and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.
- J. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- K. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.

END OF SECTION



## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

### 1.2 SECTION INCLUDES

- A. Wet-pipe sprinkler system.
- B. System design, installation, and certification.

### 1.3 RELATED SECTIONS

- A. Section 21 0500 - Common Work Results for Fire Suppression: Pipe, fittings, and valves.

### 1.4 REFERENCES

- A. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2007.
- B. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

### 1.5 SUBMITTALS

- A. See Section 21 0500 for submittal procedures.
- B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Shop Drawings:
  - 1. Submit preliminary layout indicating the routing of sprinkler piping and sprinkler locations.
  - 2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.
  - 3. Submit shop drawings and hydraulic calculations to authority having jurisdiction and Fire Marshal for approval. Submit proof of approval to Architect.
  - 4. See Drawings for additional requirements.
- D. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.
- E. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

### 1.6 QUALITY ASSURANCE

- A. Maintain one copy of referenced design and installation standard on site.
- B. Conform to FM and UL requirements.
- C. Design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Oregon.
- D. Equipment and Components: Provide products that bear FM and UL label or marking.
- E. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

## 1.7 PRE-INSTALLATION MEETING

- A. Convene one week before starting work of this section.

## 1.8 DELIVERY, STORAGE, AND PROTECTION

- A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

## 1.9 EXTRA MATERIALS

- A. Provide extra sprinklers of type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
- B. Provide suitable wrenches for each sprinkler type.
- C. Provide metal storage cabinet adjacent to fire riser.

## PART 2 PRODUCTS

### 2.1 SPRINKLER SYSTEM REQUIREMENTS

- A. Sprinkler System: Provide wet pipe coverage for building areas noted.
- B. Occupancy: Light hazard; comply with NFPA 13.
- C. Water Supply: Determine volume and pressure from water flow test data; verify hose stream allowances with Building Officials and Fire Marshal; provide 10 psig margin between the available water supply and the sprinkler demand pressures.

### 2.2 SPRINKLERS

- A. Suspended Ceiling Type: Recessed pendant type with matching push on escutcheon plate.
  - 1. Finish: Chrome plated.
  - 2. Escutcheon Plate Finish: Chrome plated.
  - 3. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- B. Exposed Area Type: Standard upright type.
  - 1. Finish: Brass.
  - 2. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- C. Sidewall Type: Recessed horizontal sidewall type with matching push on escutcheon plate and guard.
  - 1. Finish: Chrome plated.
  - 2. Escutcheon Plate Finish: Chrome plated.
  - 3. Fusible Link: Glass bulb type temperature rated for specific area hazard.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with referenced NFPA design and installation standard.
- B. Install equipment in accordance with manufacturer's instructions.
- C. Place pipe runs to minimize obstruction to other work.
- D. Place piping in concealed spaces above finished ceilings.
- E. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- F. Flush entire piping system of foreign matter.

- G. Hydrostatically test entire system.
- H. Hydrostatic and flow tests shall be witnessed by a representative from the Fire Marshal's Office; schedule tests with the City, Fire Department, and Architect.

### 3.2 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate required connection points to fire alarm system with Fire Alarm Subcontractor.
- B. Ensure required devices are installed and connected as required to fire alarm system.
- C. Coordinate locations of electric alarm with Fire Marshal, Architect, and Fire Alarm Subcontractor.

END OF SECTION









## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

### 1.2 SECTION INCLUDES

- A. Basic requirements for all work included in Division 22.
- B. Requirements for the following are included:
  - 1. Related Work (other Contract Documents and specification sections) which must be combined with the requirements of this Section.
  - 2. Submittals.
  - 3. Regulatory Requirements.
  - 4. Transportation and Handling.
  - 5. Warranty.
  - 6. Record Drawings.
  - 7. Substitution Procedures.

### 1.3 RELATED WORK

- A. This general section shall be used in conjunction with the related Contract Documents in determining the total requirements for the installation of mechanical equipment and systems.

### 1.4 SUBMITTALS

- A. See Section 01 3100 - Submittal Procedures, for submittal procedures.
- B. Project Record Documents: See Section 01 7700 - Closeout Procedures, for record document procedures, and for operation and maintenance data requirements.
- C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

### 1.5 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
  - 1. Product data: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturer's standard data to provide information specific to this Project.
  - 2. Shop drawings: Prepared specifically for this Project.
  - 3. Samples for verification.
- B. See Section 01 3100 - Submittal Procedures, for submittal procedures.

### 1.6 SUBMITTALS FOR PROJECT CLOSEOUT

- A. When the following are specified in individual sections, submit them at project closeout.
  - 1. Project record documents.
    - a. Product data.
    - b. Record Drawings: Within ten days after the date of system acceptance, the Contractor shall provide Record Drawings of the actual installation.
  - 2. Operation and maintenance data.
  - 3. Warranties.
  - 4. Bonds.
  - 5. Other types as indicated.
- B. See Section 01 2500 - Submittal Procedures, for submittal procedures.

1.7 NUMBER OF COPIES OF SUBMITTALS

- A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in installing plumbing systems in commercial buildings with minimum five years of experience.
- B. Products Requiring Electrical Connection: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.9 REGULATORY REQUIREMENTS

- A. Conformance with the latest Codes and other regulatory requirements is the responsibility of the Contractor.
- B. The Contractor shall obtain and pay for all permits, and shall arrange for all inspections required by codes applicable to this Section. The Contractor shall submit written evidence to the General Contractor that required permits, inspections and code requirements have been secured.

1.10 TRANSPORTATION AND HANDLING

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.11 WARRANTY

- A. All equipment and materials furnished and installed under this contract shall be guaranteed for a minimum period of one year from the date of acceptance thereof against defective materials, design, and workmanship. Acceptance shall be defined as the time when start-up and field testing show that the equipment operates satisfactorily and complies with all of the specification requirements.
- B. The above requirement does not negate the requirements for extended warranty periods listed in the technical specification sections.

1.12 RECORD DRAWINGS

- A. The Contractor shall keep day-to-day record of the installed locations for all equipment and materials as listed below:
  - 1. All underground piping. Maintain dimensional accuracy within plus or minus 2-inches.
  - 2. All piping concealed in walls or above ceilings that vary more than 12-inches from where they are shown routed on the contract documents.
  - 3. Identify and dimension locations of all isolation valves.
- B. Underground utility services, both inside and outside of buildings, shall be dimensioned from permanent structures or benchmark. Utility services outside of building shall also show depth of burial with reference to the finished ground floor elevation.
- C. Immediately on commencing work on the project, obtain a set of prints of the contract drawings pertaining to this branch of work. This set of drawings shall be kept on the project site at all times for use in recording "record" conditions.
- D. At the completion of the project, Record Drawings shall be certified as to their correctness by the signature of the Contractor and shall be stamped or otherwise identified as record drawings.

### 1.13 SUBSTITUTION PROCEDURES

- A. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- B. A request for substitution constitutes a representation that the submitter:
  - 1. Has investigated the proposed product and determined that it meets or exceeds the quality level of the specified product.
  - 2. Will provide the same warranty for the substitution as for the specified product.
- C. Substitution Submittal Procedure:
  - 1. See Section 01 2500 – Substitution Procedures, for substitution submittal procedure.

## PART 2 PRODUCTS

### 2.1 GENERAL

- A. All equipment shall be the manufacturer's most recent and proven standard design. Equipment designs which have not been used successfully in a similar applications are not acceptable.
- B. Materials shall be new, and shall comply with the requirements of the specified products.

### 2.2 FIRESTOP SYSTEMS

- A. Provide firestop systems at through-penetrations of fire-rated wall, shaft, floor, floor/ceiling, and roof/ceiling assemblies in accordance with the code requirements and Section 07 8443 - Fire-Resistant Joint Firestopping.
- B. Submit product data and installation instructions for each penetration type in accordance with Section 01 3300 - Submittal Procedures. Coordinate the minimum F and T rating requirements with the Architect.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. All equipment shall be installed in strict accordance with the recommendations of the manufacturer's instructions.
- B. All work shall be performed in the best and most workmanlike manner by licensed installers skilled in their respective trades.

### 3.2 PROTECTION

- A. All stock piled materials and equipment shall be protected from the weather. All stored materials and equipment shall be carefully inspected prior to installation and replaced with new if found to be damaged, corroded, etc.

### 3.3 ESCUTCHEON PLATES

- A. Provide polished chrome-plated cast brass screw flanges where plumbing pipes pass through walls, floors, ceilings, and partitions in exposed portions of the building.
- B. Provide polished chrome-plated cast brass escutcheon plates at plumbing fixture supply wall and floor penetrations.

### 3.4 HOISTING, RIGGING, TRANSPORTATION AND SCAFFOLDING

- A. Provide all scaffolding, staging, cribbing, tackle hoist and rigging necessary for installing all materials and equipment in their proper places. All temporary work shall be removed from the premises when its use is no longer required.

### 3.5 CUTTING AND PATCHING

- A. No structural members shall be cut without the approval of the Architect and any such cutting shall be done in a manner satisfactory to the Architect.
- B. All patching or repair of damage to finished work shall be done in a neat and workmanlike manner, and meet with the approval of the Architect. The Contractor whose operations require cutting finished work, or causes damage which entails repairs of such work, shall employ craftsmen of the particular trade whose work must be cut or which is damaged, and shall pay all costs associated with the patching and repair.
- C. All cutting shall be performed with machine saw. Holes for pipes in concrete walls or floors shall be cut with core drilling equipment.

### 3.6 TOOLS AND EQUIPMENT

- A. Furnish all tools and equipment necessary for the proper installation, protection and maintenance of the work.

### 3.7 EXPANSION AND CONTRACTION

- A. Take all necessary precautions required to care for the contraction and expansion of all piping.
- B. All piping shall be properly supported, guided, aligned and anchored for expansion and contraction.
- C. Provide expansion joints as required and/or as shown on the drawings.

### 3.8 CLEANING

- A. Clean premises of all excess construction material and debris caused by this work, in accordance with the general conditions.
- B. Surfaces shall be left clean, debris shall be removed, and equipment shall be furnished in prime coat finish unless otherwise specified.
- C. Clean exterior of piping, ductwork and equipment. Remove rust, plaster and dirt by wire brushing; remove grease, oil and similar materials by wiping with clean rags and suitable solvents.
- D. Do not permit traffic over unprotected floor surface.

### 3.9 PROJECT CLOSE-OUT

- A. Prior to requesting Architect's inspection for work acceptance, complete the following and list known exceptions within the request:
  - 1. Obtain final inspections and approvals from all governmental jurisdictions that are required for the project.
  - 2. Submit record drawings, operations and maintenance data, warranties, and similar record documents.
  - 3. Complete start-up, testing and demonstration of systems to ensure that the entire installation is complete, properly adjusted and is in proper operating condition.

END OF SECTION

## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

### 1.2 SECTION INCLUDES

- A. Nameplates.
- B. Tags.

### 1.3 REFERENCES

### 1.4 SUBMITTALS

- A. See Section 22 0050 for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Product Data: Provide manufacturers catalog literature for each product required.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Brady Corporation: [www.bradycorp.com](http://www.bradycorp.com).
- B. Seton Identification Products: [www.seton.com/aec](http://www.seton.com/aec).

### 2.2 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.
  - 1. Letter Color: White.
  - 2. Letter Height: 1 inch.
  - 3. Background Color: Black.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

### 3.2 INSTALLATION

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

END OF SECTION





## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

### 1.2 SECTION INCLUDES

- A. Piping insulation.
- B. Accessories.

### 1.3 RELATED SECTIONS

- A. Section 22 1005 - Plumbing Piping.

### 1.4 REFERENCES

- A. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus; 2004.
- B. ASTM C 195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2000.
- C. ASTM C 547 - Standard Specification for Mineral Fiber Pipe Insulation; 2006.
- D. ASTM C 552 - Standard Specification for Cellular Glass Thermal Insulation; 2003.
- E. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2005.
- F. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.
- G. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.
- H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; 2003.

### 1.5 SUBMITTALS

- A. See Section 22 0050 for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

### 1.6 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient conditions required by manufacturers of each product.

## PART 2 PRODUCTS

### 2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

- A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84 or UL 723.

### 2.2 GLASS FIBER

- A. Manufacturers:
  - 1. Knauf Fiber Glass: [www.knaufusa.com](http://www.knaufusa.com).
  - 2. Johns Manville Corporation: [www.jm.com](http://www.jm.com).

3. Owens Corning Corp: [www.owenscorning.com](http://www.owenscorning.com).
- B. Insulation: ASTM C 547 and ASTM C 795; rigid molded, noncombustible.
  1. 'K' value: ASTM C 177, 0.24 at 75 degrees F.
  2. Maximum service temperature: 850 degrees F.
  3. Maximum moisture absorption: 0.2 percent by volume.
- C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E 96/E 96M of 0.02 perm-inches.
- D. Vapor Barrier Lap Adhesive:
  1. Manufacturers:
    - a. Foster Model 85-75 Drion Contact Cement.
  2. Compatible with insulation.
- E. Insulating Cement/Mastic:
  1. Manufacturers:
    - a. Pabco Model Pabcate.
  2. ASTM C 195; hydraulic setting on mineral wool.

### 2.3 JACKETS

- A. PVC Plastic.
  1. Manufacturers:
    - a. Johns Manville Corporation; Model Zeston 2000: [www.jm.com](http://www.jm.com).
  2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
    - a. Minimum Service Temperature: 0 degrees F.
    - b. Maximum Service Temperature: 150 degrees F.
    - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E 96/E 96M.
    - d. Thickness: 15 mil.
    - e. Connections: Brush on welding adhesive.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Exposed Piping: Locate insulation and cover seams in least visible locations.
- C. Glass fiber insulated pipes conveying fluids below ambient temperature:
  1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
  2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- D. Glass fiber insulated pipes conveying fluids above ambient temperature:
  1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
  2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

- E. Inserts and Shields:
  - 1. Application: Piping 1-1/2 inches diameter or larger.
  - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
  - 3. Insert location: Between support shield and piping and under the finish jacket.
  - 4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
  - 5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- F. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.
- G. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor), pipe exposed in the Kitchen: Finish with PVC jacket and fitting covers.

### 3.3 SCHEDULES

- A. Plumbing Systems:
  - 1. Domestic Hot Water Supply:
    - a. Glass Fiber Insulation.
    - b. Thickness: See Schedule on Drawings.
  - 2. Domestic Cold Water:
    - a. Glass Fiber Insulation.
    - b. Thickness: See Schedule on Drawings.

END OF SECTION



## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

### 1.2 SECTION INCLUDES

- A. Pipe, pipe fittings, valves, and connections for piping systems.
  - 1. Sanitary waste and vent.
  - 2. Domestic hot and cold water.
  - 3. Natural gas.

### 1.3 RELATED SECTIONS

- A. Section 22 0719 - Plumbing Piping Insulation.

### 1.4 REFERENCES

- A. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).
- B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005) (ANSI B16.18).
- C. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005).
- D. ASME B31.1 - Power Piping; The American Society of Mechanical Engineers; 2004 (ANSI/ASME B31.1).
- E. ASME B31.2 - Fuel Gas Piping; The American Society of Mechanical Engineers; 1968.
- F. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2004 (ANSI/ASME B31.9).
- G. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2005.
- H. ASTM A 234/A 234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2005a.
- I. ASTM B 32 - Standard Specification for Solder Metal; 2004.
- J. ASTM B 42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2002.
- K. ASTM B 88 - Standard Specification for Seamless Copper Water Tube; 2003.
- L. ASTM B 88M - Standard Specification for Seamless Copper Water Tube (Metric); 2005.
- M. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; 2000 (ANSI/AWWA C111/A21.11).
- N. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; 2002 (ANSI/AWWA C151/A21.51).
- O. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; Cast Iron Soil Pipe Institute; 2005.
- P. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; Cast Iron Soil Pipe Institute; 2004.

- Q. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2006.
- R. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.
- S. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 1996.
- T. NFPA 54 - National Fuel Gas Code; National Fire Protection Association; 2006.

#### 1.5 SUBMITTALS

- A. See Section 22 0050 for submittal procedures.
- B. Project Record Documents: Record actual routing of piping, and locations for fittings and valving. Maintain and furnish Record Drawings in accordance with Section 22 0050.

#### 1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with State of Oregon, standards.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.

#### 1.7 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with State of Oregon plumbing code.
- B. Conform to applicable code for installation of backflow prevention devices.

#### 1.8 DELIVERY, STORAGE, AND PROTECTION

- A. Provide temporary protective coating on cast iron and steel valves.
- B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

#### 1.9 ENVIRONMENTAL REQUIREMENTS

- A. Do not install underground piping when bedding is wet or frozen.

### PART 2 PRODUCTS

#### 2.1 SANITARY VENT PIPING

- A. Cast Iron Pipe: CISPI 301, hubless.
  - 1. Fittings: Cast iron.
  - 2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

#### 2.2 SANITARY WASTE , BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Pipe: CISPI 301, hubless.
  - 1. Fittings: Cast iron.
  - 2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

#### 2.3 SANITARY WASTE PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
  - 1. Fittings: Cast iron.
  - 2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

## 2.4 WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Copper Pipe: ASTM B 88, Type K, hard drawn.
  - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
  - 2. Joints: ASTM B 32, alloy Sn95 solder.

## 2.5 WATER PIPING, ABOVE GRADE, EXPOSED

- A. Copper Tube: ASTM B 88 (ASTM B 88M), Type L (B), Drawn (H).
  - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
  - 2. Joints: ASTM B 32, alloy Sn95 solder.

## 2.6 WATER PIPING, ABOVE GRADE, CONCEALED

- A. Copper Tube: ASTM B 88 (ASTM B 88M), Type L (B), Drawn (H).
  - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
  - 2. Joints: ASTM B 32, alloy Sn95 solder.

## 2.7 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Steel Pipe: ASTM A 53/A 53M Schedule 40 black.
  - 1. Fittings: ASTM A 234/A 234M, wrought steel welding type.
  - 2. Joints: ASME B31.1, welded.
  - 3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

## 2.8 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A 53/A 53M Schedule 40 black.
  - 1. Fittings: ASME B16.3, malleable iron, or ASTM A 234/A 234M, wrought steel welding type.
  - 2. Joints: NFPA 54, threaded or welded to ASME B31.2.

## 2.9 FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 Inches and Under:
  - 1. Ferrous pipe: Class 150 malleable iron threaded unions.
  - 2. Copper tube and pipe: Class 150 bronze unions with soldered joints.
- B. Flanges for Pipe Size Over 1 Inch:
  - 1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
  - 2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
- C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

## 2.10 PIPE HANGERS AND SUPPORTS

- A. Plumbing Piping - Drain, Waste, and Vent:
  - 1. Conform to ASME B31.9.
- B. Plumbing Piping - Water:
  - 1. Conform to ASME B31.9.
  - 2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
  - 3. Hangers for Hot and Cold Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.
  - 4. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
  - 5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

6. Floor Support for Hot and Cold Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
  7. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- C. Natural Gas Piping
1. Conform to ASME B31.9.

## 2.11 BALL VALVES

- A. Manufacturers:
1. Conbraco Industries, Apollo 77 Series: [www.conbraco.com](http://www.conbraco.com).
  2. Nibco, Inc: [www.nibco.com](http://www.nibco.com).
  3. Milwaukee Valve Company: [www.milwaukeevalve.com](http://www.milwaukeevalve.com).
- B. Construction, 4 Inches and Smaller: MSS SP-110, 400 psi CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder ends with union.

## 2.12 GAS VALVES

- A. Manufacturers:
1. Jenkins Bros.
  2. Lukenheimer Co.
  3. Powell Co.
  4. Stockham.
  5. Nibco, Inc: [www.nibco.com](http://www.nibco.com).
- B. Gas Cocks 2 inches and smaller: 150 psi WOG, bronze body, straight-away pattern, square head, threaded ends.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

### 3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 0719.



- H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with the Architect.
- I. Establish elevations of buried piping outside the building to ensure not less than 2 ft of cover.
- J. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.
- K. Install valves with stems upright or horizontal, not inverted.
- L. Install water piping to ASME B31.9.
- M. Sleeve pipes passing through partitions, walls and floors.
- N. Pipe Hangers and Supports:
  - 1. Install in accordance with the Oregon Plumbing Specialty Code, Section 314.0.
  - 2. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
  - 3. Place hangers within 18 inches of each horizontal elbow.
  - 4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - 5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
  - 6. Provide copper plated hangers and supports for copper piping.

### 3.4 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- C. Provide plug valves in natural gas systems for shut-off service.

### 3.5 ERECTION TOLERANCES

- A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope, unless otherwise noted.
- B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

### 3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfect water distribution system in accordance with Health Authority requirements.

### 3.7 SCHEDULES

- A. Pipe Hanger Spacing:
  - 1. Metal Piping:
    - a. Pipe size: 1/2 inches to 1-1/4 inches:
      - 1) Maximum hanger spacing: 6.5 ft.
      - 2) Hanger rod diameter: 3/8 inches.
    - b. Pipe size: 1-1/2 inches to 2 inches:
      - 1) Maximum hanger spacing: 10 ft.
      - 2) Hanger rod diameter: 3/8 inch.
    - c. Pipe size: 2-1/2 inches to 3 inches:
      - 1) Maximum hanger spacing: 10 ft.
      - 2) Hanger rod diameter: 1/2 inch.
    - d. Pipe size: 4 inches to 6 inches:
      - 1) Maximum hanger spacing: 10 ft.
      - 2) Hanger rod diameter: 5/8 inch.

2. Plastic Piping:
  - a. All Sizes:
    - 1) Per manufacturer's written instructions.

END OF SECTION

## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

### 1.2 SECTION INCLUDES

- A. Floor drains.
- B. Roof drains.
- C. Cleanouts.
- D. Floor sinks.
- E. Trap primer valves.
- F. Water hammer arrestors.
- G. Grease Traps.

### 1.3 RELATED SECTIONS

- A. Section 22 1005 - Plumbing Piping.
- B. Section 22 3000 - Plumbing Equipment
- C. Section 22 4000 - Plumbing Fixtures.

### 1.4 REFERENCES

- A. ASME A112.6.3 - Floor and Trench Drains; The American Society of Mechanical Engineers; 2001.
- B. PDI-WH 201 - Water Hammer Arresters; Plumbing and Drainage Institute; 2006.

### 1.5 SUBMITTALS

- A. See Section 22 0050 for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Project Record Documents: Record actual locations of equipment, cleanouts, water hammer arrestors.
- D. Operation Data: Indicate frequency of treatment required for interceptors.
- E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

## PART 2 PRODUCTS

### 2.1 PLUMBING SPECIALTIES

- A. See Plumbing Fixture Schedule and call-outs on Drawings.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur (e.g., at janitor rooms, irrigation systems, interior and exterior hose bibbs, etc.).
- F. Pipe relief from backflow preventer to nearest drain.
- G. Install water hammer arrestors complete with accessible isolation valve on cold water supply piping to water closets. Coordinate access requirements with the Architect and General Contractor.

END OF SECTION

## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

### 1.2 SECTION INCLUDES

- A. Water heaters.

### 1.3 SUBMITTALS

- A. See Section 22 0050 for submittal procedures.
- B. Product Data:
  - 1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping and
  - 2. Provide electrical characteristics and connection requirements.
- C. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
- D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

### 1.4 CERTIFICATIONS

- A. Water Heaters: NSF approved.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

### 1.5 DELIVERY, STORAGE, AND PROTECTION

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

### 1.6 WARRANTY

- A. See Section 22 0050 for additional warranty requirements.
- B. Provide six year manufacturer's warranty for residential domestic water heaters.

## PART 2 PRODUCTS

### 2.1 INSTANT HOT WATER DISPENSERS

- A. Type: Electric with instant self-closing hot water valve.
- B. Capacity: 1/3 gallon tank; 40 cups of 190 deg F water per hour.
- C. Thermostat: Snap-action, adjustable from 160 deg F to 200 deg F.
- D. Construction: Copper tank, valve, and tubing; stainless steel gooseneck spout.

### 2.2 RESIDENTIAL ELECTRIC WATER HEATERS

- A. Type: Automatic, electric, vertical storage.
- B. Performance as scheduled on the drawings.
- C. Tank: Glass lined welded steel; thermally insulated with minimum 2-1/2 inches CFC free foam encased in corrosion-resistant steel jacket; baked-on enamel finish.

- D. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F, flanged or screw-in nichrome elements, high temperature limit thermostat.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.
- B. Coordinate with plumbing piping and related electrical work to achieve operating system.

END OF SECTION

## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

### 1.2 SECTION INCLUDES

- A. Water closets.
- B. Urinals.
- C. Lavatories.
- D. Sinks.
- E. Mop sinks.
- F. Drinking fountains.

### 1.3 RELATED SECTIONS

- A. Section 22 1005 - Plumbing Piping.
- B. Section 22 1006 - Plumbing Piping Specialties.
- C. Section 22 3000 - Plumbing Equipment.

### 1.4 REFERENCES

- A. ANSI Z124.1 - American National Standard for Plastic Bathtub Units; 1995.
- B. ANSI Z124.2 - American National Standard for Plastic Shower Units; 1995.
- C. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; The American Society of Mechanical Engineers; 1997 (Reaffirmed 2002).
- D. ASME A112.18.1 - Plumbing Supply Fittings; The American Society of Mechanical Engineers; 2005.
- E. ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures; The American Society of Mechanical Engineers; 1994 (R2004).
- F. ASME A112.19.2 - Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals; The American Society of Mechanical Engineers; 2003.
- G. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use); The American Society of Mechanical Engineers; 2000 (R2004).
- H. ASME A112.19.4M - Porcelain Enameled Formed Steel Plumbing Fixtures; The American Society of Mechanical Engineers; 1994 (R2004).
- I. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals; The American Society of Mechanical Engineers; 2005.

### 1.5 SUBMITTALS

- A. See Section 22 0050 for submittal procedures.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Manufacturer's Instructions: Indicate installation methods and procedures.

- D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

#### 1.7 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

#### 1.8 DELIVERY, STORAGE, AND PROTECTION

- A. Accept fixtures on site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

#### 1.9 WARRANTY

- A. See Section 22 0050 for additional warranty requirements.

### PART 2 PRODUCTS

#### 2.1 PLUMBING FIXTURES

- A. See Plumbing Fixture Schedule on Drawings.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that electric power is available and of the correct characteristics.
- C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

#### 3.2 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

#### 3.3 INSTALLATION

- A. Install components level and plumb.
- B. Seal fixtures to wall and floor surfaces with sealant, color to match fixture.

END OF SECTION







## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

### 1.2 SECTION INCLUDES

- A. Basic requirements for all work included in Division 23.
- B. Requirements for the following are included:
  - 1. Related Work (other Contract Documents and specification sections) which must be combined with the requirements of this Section.
  - 2. Submittals.
  - 3. Regulatory Requirements.
  - 4. Transportation and Handling.
  - 5. Warranty.
  - 6. Record Drawings.
  - 7. Substitution Procedures.

### 1.3 RELATED WORK

- A. This general section shall be used in conjunction with the related Contract Documents in determining the total requirements for the installation of mechanical equipment and systems.

### 1.4 SUBMITTALS

- A. See Section 01 3100 - Submittal Procedures, for submittal procedures.
- B. Project Record Documents: See Section 01 7700 - Closeout Procedures, for record document procedures.
- C. Project Record Documents: See Section 01 7700 - Closeout Procedures, for operation and maintenance data requirements.
- D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

### 1.5 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
  - 1. Product data: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturer's standard data to provide information specific to this Project.
  - 2. Shop drawings: Prepared specifically for this Project.
  - 3. Samples for verification.
- B. See Section 01 3300 - Submittal Procedures, for submittal procedures.

### 1.6 SUBMITTALS FOR PROJECT CLOSEOUT

- A. When the following are specified in individual sections, submit them at project closeout.
  - 1. Project record documents.
    - a. Product data.
    - b. Record Drawings: Within ten days after the date of system acceptance, the Contractor shall provide Record Drawings of the actual installation.
  - 2. Operation and maintenance data.
  - 3. Warranties.
  - 4. Bonds.

5. Other types as indicated.

B. See Section 01 3100 - Submittal Procedures, for submittal procedures.

#### 1.7 NUMBER OF COPIES OF SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

#### 1.8 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing HVAC systems in commercial buildings with minimum five years of experience.

B. Products Requiring Electrical Connection: Listed and classified by UL or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

#### 1.9 REGULATORY REQUIREMENTS

A. Conformance with the latest Codes and other regulatory requirements is the responsibility of the Contractor.

B. The Contractor shall obtain and pay for all permits, and shall arrange for all inspections required by codes applicable to this Section. The Contractor shall submit written evidence to the General Contractor that required permits, inspections and code requirements have been secured.

#### 1.10 TRANSPORTATION AND HANDLING

A. Transport and handle products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

#### 1.11 WARRANTY

A. All equipment and materials furnished and installed under this contract shall be guaranteed for a minimum period of one year from the date of acceptance thereof against defective materials, design, and workmanship. Acceptance shall be defined as the time when start-up and field testing show that the equipment operates satisfactorily and complies with all of the specification requirements.

B. The above requirement does not negate the requirements for extended warranty periods listed in the technical specification sections.

#### 1.12 RECORD DRAWINGS

A. The Contractor shall keep day-to-day record of the installed locations for all equipment and materials as listed below:

1. All piping concealed in walls or above ceilings that vary more than 12-inches from where they are shown routed on the contract documents.
2. Identify and dimension locations of all isolation valves.
3. Duct concealed in walls or above ceilings that vary more than 12-inches from where they are shown routed on the contract documents.

B. Underground utility services, both inside and outside of buildings, shall be dimensioned from permanent structures or benchmark. Utility services outside of building shall also show depth of burial with reference to the finished ground floor elevation.

C. Immediately on commencing work on the project, obtain a set of prints of the contract drawings pertaining to this branch of work. This set of drawings shall be kept on the project site at all times for use in recording "record" conditions.

- D. At the completion of the project, Record Drawings shall be certified as to their correctness by the signature of the Contractor and shall be stamped or otherwise identified as record drawings.

#### 1.13 SUBSTITUTION PROCEDURES

- A. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- B. A request for substitution constitutes a representation that the submitter:
  - 1. Has investigated the proposed product and determined that it meets or exceeds the quality level of the specified product.
  - 2. Will provide the same warranty for the substitution as for the specified product.
- C. Substitution Submittal Procedure:
  - 1. See Section 01 2500 – Substitution Procedures, for substitution submittal procedure.

### PART 2 PRODUCTS

#### 2.1 GENERAL

- A. All equipment shall be the manufacturer's most recent and proven standard design. Equipment designs which have not been used successfully in a similar applications are not acceptable.
- B. Materials shall be new, and shall comply with the requirements of the specified products.

#### 2.2 FIRESTOP SYSTEMS

- A. Provide firestop systems at through-penetrations of fire-rated wall, shaft, floor, floor/ceiling, and roof/ceiling assemblies in accordance with the code requirements and Section 07 8443 - Fire-Resistant Joint Firestopping.
- B. Submit product data and installation instructions for each penetration type in accordance with Section 01 3300 - Submittal Procedures. Coordinate the minimum F and T rating requirements with the Architect.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. All equipment shall be installed in strict accordance with the recommendations of the manufacturer's instructions.
- B. All work shall be performed in the best and most workmanlike manner by licensed installers skilled in their respective trades.

#### 3.2 PROTECTION

- A. All stock piled materials and equipment shall be protected from the weather. All stored materials and equipment shall be carefully inspected prior to installation and replaced with new if found to be damaged, corroded, etc.

#### 3.3 HOISTING, RIGGING, TRANSPORTATION AND SCAFFOLDING

- A. Provide all scaffolding, staging, cribbing, tackle hoist and rigging necessary for installing all materials and equipment in their proper places. All temporary work shall be removed from the premises when its use is no longer required.

#### 3.4 CUTTING AND PATCHING

- A. No structural members shall be cut without the approval of the Architect and any such cutting shall be done in a manner satisfactory to the Architect.

- B. All patching or repair of damage to finished work shall be done in a neat and workmanlike manner, and meet with the approval of the Architect. The Contractor whose operations require cutting finished work, or causes damage which entails repairs of such work, shall employ craftsmen of the particular trade whose work must be cut or which is damaged, and shall pay all costs associated with the patching and repair.
- C. All cutting shall be performed with machine saw. Holes for pipes in concrete walls or floors shall be cut with core drilling equipment.

### 3.6 TOOLS AND EQUIPMENT

- A. Furnish all tools and equipment necessary for the proper installation, protection and maintenance of the work.

### 3.7 EXPANSION AND CONTRACTION

- A. Take all necessary precautions required to care for the contraction and expansion of all piping.
- B. All piping shall be properly supported, guided, aligned and anchored for expansion and contraction.
- C. Provide expansion joints as required and/or as shown on the drawings.

### 3.8 CLEANING

- A. Clean premises of all excess construction material and debris caused by this work, in accordance with the general conditions.
- B. Surfaces shall be left clean, debris shall be removed, and equipment shall be furnished in prime coat finish unless otherwise specified.
- C. Clean exterior of piping, ductwork and equipment. Remove rust, plaster and dirt by wire brushing; remove grease, oil and similar materials by wiping with clean rags and suitable solvents.
- D. Do not permit traffic over unprotected floor surface.

### 3.9 PROJECT CLOSE-OUT

- A. Prior to requesting Architect's inspection for work acceptance, complete the following and list known exceptions within the request:
  - 1. Obtain final inspections and approvals from all governmental jurisdictions that are required for the project.
  - 2. Submit record drawings, operations and maintenance data, warranties, and similar record documents.
  - 3. Complete start-up, testing and demonstration of systems to ensure that the entire installation is complete, properly adjusted and is in proper operating condition.

END OF SECTION

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

- A. Vibration isolators.

### 1.2 SUBMITTALS

- A. See Section 23 0050 for submittal procedures.
- B. Product Data: Provide schedule of vibration isolator type with location and load on each.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Kinetics Noise Control, Inc; [www.kineticsnoise.com](http://www.kineticsnoise.com).
- B. Mason Industries; Model; [www.mason-ind.com](http://www.mason-ind.com).

### 2.2 VIBRATION ISOLATORS

- A. Neoprene Pad Isolators:
  - 1. Rubber or neoprene waffle pads.
    - a. Hardness: 30 durometer.
    - b. Thickness: Minimum 1/2 inch.
    - c. Maximum Loading: 50 psi.
    - d. Rib Height: Maximum 0.7 times width.
  - 2. Configuration: Single layer.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

### 3.2 SCHEDULE

- A. Equipment Isolation Schedule.
  - 1. Air Cooled Condensing Units.
    - a. Isolator Type: Neoprene Pad.

END OF SECTION





## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

### 1.2 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.
- B. Measurement of final operating condition of HVAC systems.

### 1.3 REFERENCES

- A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council; 2002.
- B. ASHRAE Std 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 1988.
- C. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; National Environmental Balancing Bureau; 2005, Seventh Edition.

### 1.4 SUBMITTALS

- A. See Section 23 0050 for submittal procedures.
- B. Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 10 days after award of Contract.
- C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
  - 1. Include at least the following in the plan:
    - a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
    - b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
    - c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
    - d. Final test report forms to be used.
    - e. Procedures for formal deficiency reports, including scope, frequency and distribution.
- D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
  - 1. Revise TAB plan to reflect actual procedures and submit as part of final report.
  - 2. Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.
  - 3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for the Architect and for inclusion in operating and maintenance manuals.
  - 4. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
  - 5. Include actual instrument list, with manufacturer name, serial number, and date of calibration.

6. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
7. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
8. Test Reports: Indicate data on AABC MN-1 forms, forms prepared following ASHRAE Std 111, or NEBB forms.
9. Include the following on the title page of each report:
  - a. Name of Testing, Adjusting, and Balancing Agency.
  - b. Address of Testing, Adjusting, and Balancing Agency.
  - c. Telephone number of Testing, Adjusting, and Balancing Agency.
  - d. Project name.
  - e. Project location.
  - f. Project Architect.
  - g. Project Engineer.
  - h. General Contractor.
  - i. Mechanical/HVAC Contractor.
  - j. Project altitude.
  - k. Report date.

#### 1.5 QUALITY ASSURANCE

- A. Perform total system balance in accordance with AABC MN-1, ASHRAE Std 111, or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.
- B. TAB Agency Qualifications: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years documented experience certified by AABC.
- C. Perform Work under supervision of AABC Certified Test and Balance Engineer, NEBB Certified Testing, Balancing and Adjusting Supervisor, or registered Professional Engineer experienced in performance of this Work and licensed in Oregon.

#### 1.6 SEQUENCING AND SCHEDULING

- A. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.

#### 1.7 WARRANTY

- A. Furnish AABC National Performance Guaranty for this project.

### PART 2 PRODUCTS - NOT USED

### PART 3 EXECUTION

#### 3.1 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
  1. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
  2. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
  3. SMACNA HVAC Systems Testing, Adjusting, and Balancing.
- B. Maintain at least one copy of the standard to be used at project site at all times.
- C. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- D. TAB Agency Qualifications:
  1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
  2. Having minimum of three years documented experience.

3. Certified by one of the following:
  - a. NEBB, National Environmental Balancing Bureau: [www.nebb.org](http://www.nebb.org).
  - b. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: [www.tabbcertified.org](http://www.tabbcertified.org).

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

### 3.2 TESTING, ADJUSTING, AND BALANCING AGENCIES

- A. Pacific Coast Air Balancing.
- B. Northwest Engineering.
- C. Neudorfer Engineers.
- D. No Substitutions.

### 3.3 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
  1. Systems are started and operating in a safe and normal condition.
  2. Temperature control systems are installed complete and operable.
  3. Proper thermal overload protection is in place for electrical equipment.
  4. Duct systems are clean of debris.
  5. Fans are rotating correctly.
  6. Volume dampers are in place and open.
  7. Air coil fins are cleaned and combed.
  8. Access doors are closed and duct end caps are in place.
  9. Air outlets are installed and connected.
  10. Duct system leakage is minimized.
- B. Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.

### 3.4 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to the Engineer to facilitate spot checks during testing.
- B. Provide additional balancing devices as required.

### 3.5 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 5 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 5 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

### 3.6 RECORDING AND ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

- E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

### 3.7 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- B. Measure air quantities at air inlets and outlets.
- C. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- D. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- E. Provide system schematic on full-size drawings or on 11x17 reduced drawings folded and inserted into the report. Schematic shall show required and actual air quantities recorded at each outlet or inlet.
- F. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- G. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- H. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

END OF SECTION

## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

### 1.2 SECTION INCLUDES

- A. Duct insulation.
- B. Duct Liner.

### 1.3 REFERENCES

- A. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2004.
- B. ASTM C 553 - Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2002.
- C. ASTM C 612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2004.
- D. ASTM C 1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2005.
- E. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2005.
- F. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.
- G. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.
- H. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.
- I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; 2003.

### 1.4 SUBMITTALS

- A. See Section 23 0050 for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures which ensure acceptable workmanship and installation standards will be achieved.

### 1.5 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

## PART 2 PRODUCTS

### 2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

- A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

## 2.2 GLASS FIBER, FLEXIBLE

- A. Manufacturer:
  - 1. Knauf Fiber Glass: [www.knaufusa.com](http://www.knaufusa.com).
  - 2. Johns Manville Corporation: [www.jm.com](http://www.jm.com).
  - 3. Owens Corning Corp: [www.owenscorning.com](http://www.owenscorning.com).
- B. Insulation: ASTM C 553; flexible, noncombustible blanket.
  - 1. 'K' value: 0.31 at 75 degrees F, when tested in accordance with ASTM C 518.
  - 2. Maximum Service Temperature: 450 degrees F.
  - 3. Maximum Water Vapor Sorption: 5.0 percent by weight.
- C. Vapor Barrier Jacket:
  - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
  - 2. Moisture Vapor Permeability: 0.029 ng/Pa s m (0.02 perm inch), when tested in accordance with ASTM E 96/E 96M.
  - 3. Secure with pressure sensitive tape.
- D. Vapor Barrier Tape:
  - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- E. Tie Wire: Annealed steel, 16 gage.

## 2.3 DUCT LINER

- A. Manufacturers:
  - 1. Knauf Fiber Glass: [www.knaufusa.com](http://www.knaufusa.com).
  - 2. Johns Manville Corporation: [www.jm.com](http://www.jm.com).
  - 3. Owens Corning Corp: [www.owenscorning.com](http://www.owenscorning.com).
- B. Insulation: Incombustible glass fiber complying with ASTM C 1071; flexible blanket, rigid board, and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer, or acrylic polymer shown to be fungus and bacteria resistant by testing to ASTM G 21.
  - 1. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
  - 2. Service Temperature: Up to 250 degrees F.
  - 3. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.
  - 4. Minimum Noise Reduction Coefficients:
    - a. 1 inch Thickness: 0.45.
- C. Adhesive: Waterproof, fire-retardant type.
- D. Liner Fasteners: Galvanized steel, self-adhesive pad, impact applied, or welded with integral, or press-on head.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that ducts have been tested before applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Insulated ducts conveying air below ambient temperature:
  - 1. Provide insulation with vapor barrier jackets.
  - 2. Finish with tape and vapor barrier jacket.
  - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

- C. Insulated ducts conveying air above ambient temperature:
  - 1. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

### 3.3 SCHEDULES

- A. See Ductwork Insulation Schedule on Drawings.

END OF SECTION





## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

### 1.2 SECTION INCLUDES

- A. Piping.
- B. Refrigerant.
- C. Valves.
- D. Strainers.
- E. Flexible connections.

### 1.3 RELATED SECTIONS

- A. Section 22 0719 - Plumbing Piping Insulation.
- B. Section 23 5400 - Furnaces.

### 1.4 REFERENCES

- A. ARI 710 - Performance Rating of Liquid-Line Dryers; Air-Conditioning and Refrigeration Institute; 2004.
- B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2004.
- C. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2004.
- D. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2004.
- E. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005).
- F. ASME B16.26 - Cast Copper Alloy Fittings For Flared Copper Tubes; The American Society of Mechanical Engineers; 2006.
- G. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; The American Society of Mechanical Engineers; 2001.
- H. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2004 (ANSI/ASME B31.9).
- I. ASTM B 88 - Standard Specification for Seamless Copper Water Tube; 2003.
- J. ASTM B 88M - Standard Specification for Seamless Copper Water Tube (Metric); 2005.
- K. ASTM B 280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2003.
- L. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society; 2004 and errata.

## 1.5 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.
- C. Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.
- D. Strainers:
  - 1. Use line size strainer upstream of each automatic valve.

## 1.6 SUBMITTALS

- A. See Section 23 0050 for submittal procedures.
- B. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.
- C. Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.
- D. Project Record Documents: Record actual routing of piping, and locations of equipment and refrigeration accessories. Maintain and provide Record Documents in accordance with Section 23 0050.
- E. Maintenance Data: Include instructions for changing cartridges, assembly views, spare parts lists.

## 1.7 QUALITY ASSURANCE

- A. Installer: Company specializing in performing the type of work specified in this section, with minimum five years of experience.

## 1.8 REGULATORY REQUIREMENTS

- A. Conform to ASME B31.9 for installation of piping system.
- B. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.
- C. Welders Certification: In accordance with ASME (BPV IX).

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store piping and specialties in shipping containers with labeling in place.
- B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.
- C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

## PART 2 PRODUCTS

### 2.1 PIPING

- A. Copper Tube: ASTM B 280, H58 hard drawn or O60 soft annealed.
  - 1. Fittings: ASME B16.22 wrought copper.
  - 2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy.

- B. Copper Tube to 7/8 inch OD: ASTM B 88 (ASTM B 88M), Type K (A), annealed.
  - 1. Fittings: ASME B16.26 cast copper.
  - 2. Joints: Flared.
- C. Pipe Supports and Anchors:
  - 1. Conform to ASME B31.5.
  - 2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron adjustable swivel, split ring.
  - 3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
  - 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
  - 5. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
  - 6. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

## 2.2 REFRIGERANT

- A. Refrigerant: R-410a.

## 2.3 VALVES

- A. Manufacturers:
  - 1. Hansen Technologies Corporation: [www.hantech.com](http://www.hantech.com).
  - 2. Henry Technologies: [www.henrytech.com](http://www.henrytech.com).
  - 3. Danfoss Automatic Controls: [www.danfoss.com](http://www.danfoss.com).
- B. Diaphragm Packless Valves:
  - 1. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends, with positive backseating; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.
- C. Service Valves:
  - 1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

## 2.4 STRAINERS

- A. Straight Line or Angle Line Type:
  - 1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

## 2.5 FLEXIBLE CONNECTORS

- A. Manufacturers:
  - 1. Circuit Hydraulics, Ltd: [www.circuit-hydraulics.co.uk](http://www.circuit-hydraulics.co.uk).
  - 2. Flexicraft Industries: [www.flexicraft.com](http://www.flexicraft.com).
  - 3. Penflex: [www.penflex.com](http://www.penflex.com).
- B. Corrugated bronze hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure of 300 psi.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

### 3.2 INSTALLATION

- A. Install refrigeration specialties in accordance with manufacturer's instructions.

- B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.
- C. Install piping to conserve building space and avoid interference with use of space.
- D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Pipe Hangers and Supports:
  - 1. Install in accordance with ASME B31.5.
  - 2. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
  - 3. Place hangers within 12 inches of each horizontal elbow.
  - 4. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
  - 5. Provide copper plated hangers and supports for copper piping.
  - 6. For insulated piping, provide sheet metal sleeve around outside of insulation a minimum of 12 inches long. Support insulated piping with pipe clamp and unistrut.
- G. Provide clearance for installation of insulation and access to valves and fittings.
- H. Provide access to concealed valves and fittings.
- I. Flood piping system with nitrogen when brazing.
- J. Insulate piping; refer to Section 22 0719.
- K. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.
- L. Fully charge completed system with refrigerant after testing.

### 3.3 FIELD QUALITY CONTROL

- A. Test refrigeration system in accordance with ASME B31.5 and manufacturer's recommendations.
- B. Pressure test system with dry nitrogen to 500 psi. Perform final tests at 500 microns and 500 psig. Test to no leakage.

### 3.4 SCHEDULES

- A. Hanger Spacing for Copper Tubing.
  - 1. 1/2 inch, 5/8 inch, and 7/8 inch OD: Maximum span, 5 feet; minimum rod size, 1/4 inch.
  - 2. 1-1/8 inch OD: Maximum span, 6 feet; minimum rod size, 1/4 inch.

END OF SECTION

## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

### 1.2 SECTION INCLUDES

- A. Metal ductwork.

### 1.3 RELATED SECTIONS

- A. Section 23 3300 - Air Duct Accessories.
- B. Section 23 3700 - Air Outlets and Inlets.
- C. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

### 1.4 REFERENCES

- A. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2005a.
- B. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

### 1.5 SUBMITTALS

- A. See Section 23 0050 for submittal procedures.
- B. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used. Maintain and provide Record Drawings in accordance with Section 23 0050.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Galvanized Steel Ducts: Hot-dipped galvanized steel sheet, ASTM A 653/A 653M FS Type B, with G90/Z275 coating.
- B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
  - 1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
  - 2. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E 84.
  - 3. Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.
- C. Hanger Rod: ASTM A 36/A 36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

### 2.2 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

- B. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation (Airsan Accoustiturn or equal).
- C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

### 2.3 MANUFACTURED METAL DUCTWORK AND FITTINGS

- A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- C. Install and seal metal and flexible ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- D. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- E. Use double nuts and lock washers on threaded rod supports.
- F. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

### 3.2 SCHEDULES

- A. Ductwork Material:
  - 1. Low Pressure Supply: Galvanized Steel.
  - 2. Return and Relief: Galvanized Steel.
  - 3. General Exhaust: Galvanized Steel.
  - 4. Outside Air Intake: Galvanized Steel.
- B. Ductwork Pressure Class:
  - 1. Low Pressure Supply: 1 inch.
  - 2. Return and Relief: 1 inch.
  - 3. General Exhaust: 1 inch.
  - 4. Outside Air Intake: 1 inch.
- C. Ductwork Seal Class:
  - 1. Supply: SMACNA Seal Class C.
  - 2. Return and Relief: SMACNA Seal Class C.
  - 3. General Exhaust: SMACNA Seal Class C.

END OF SECTION

## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

### 1.2 SECTION INCLUDES

- A. Air turning devices/extractors.
- B. Duct test holes.
- C. Volume control dampers.

### 1.3 RELATED SECTIONS

- A. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
- B. Section 23 3100 - HVAC Ducts and Casings.

### 1.4 REFERENCES

- A. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems; National Fire Protection Association; 2002.
- B. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.
- C. UL 33 - Heat Responsive Links for Fire-Protection Service; Underwriters Laboratories Inc.; 2003.
- D. UL 555 - Standard for Fire Dampers; Underwriters Laboratories Inc.; 2006.
- E. UL 555S - Standard for Leakage Rated Dampers for Use in Smoke Control Systems; Underwriters Laboratories Inc.; 1999.

### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

## PART 2 PRODUCTS

### 2.1 AIR TURNING DEVICES/EXTRACTORS

- A. Manufacturers:
  - 1. Krueger: [www.krueger-hvac.com](http://www.krueger-hvac.com).
  - 2. Ruskin Company: [www.ruskin.com](http://www.ruskin.com).
  - 3. Titus: [www.titus-hvac.com](http://www.titus-hvac.com).
- B. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

### 2.2 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

### 2.3 VOLUME CONTROL DAMPERS

- A. Manufacturers:
  - 1. Nailor Industries Inc: [www.nailor.com](http://www.nailor.com).
  - 2. Ruskin Company: [www.ruskin.com](http://www.ruskin.com).
  - 3. Greeneheck.
- B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- C. End Bearings: Except in round ducts 12 inches and smaller, provide end bearing. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.
- D. Quadrants:
  - 1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
  - 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 3100 for duct construction and pressure class.
- B. Provide duct test holes where indicated and required for testing and balancing purposes.
- C. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- D. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment; see Section 22 0548.

END OF SECTION



## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

### 1.2 SECTION INCLUDES

- A. Ceiling exhaust fans.

### 1.3 RELATED SECTIONS

- A. Section 23 300 – Air Duct Accessories.

### 1.4 REFERENCES

- A. AMCA 99 - Standards Handbook; Air Movement and Control Association International, Inc.; 2003.
- B. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; Air Movement and Control Association International, Inc.; 1999 (ANSI/AMCA 210, same as ANSI/ASHRAE 51).
- C. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; Air Movement and Control Association International, Inc.; <http://www.amca.org/licenses/search.aspx>.
- D. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; Air Movement and Control Association International, Inc.; 2005.
- E. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; Air Movement and Control Association International, Inc.; 2006.
- F. UL 705 - Power Ventilators; Underwriters Laboratories Inc.; 2004.

### 1.5 SUBMITTALS

- A. See Section 23 0050 for submittal procedures.
- B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.
- C. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

### 1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Carnes Company: [www.carnes.com](http://www.carnes.com)
- B. Greenheck: [www.greenheck.com](http://www.greenheck.com).
- C. Loren Cook Company: [www.lorencook.com](http://www.lorencook.com).

## 2.2 CEILING EXHAUST FANS

- A. Performance: As scheduled on the drawings.
- B. Fan Unit: High-efficiency centrifugal blower, permanently lubricated motor with neoprene anti-vibration motor mounts, integral backdraft damper and birdscreen.
- C. Accessories: Roof caps and other accessories as scheduled or indicated on the drawings.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Coordinate the installation of the roof penetrations and roof caps with the roofing work and the Contractor.
- C. Provide control interlocks as indicated on the drawings. Control devices and wiring to comply with Electrical requirements.
- D. Provide backdraft dampers on outlet from ceiling exhaust fans and as indicated.

END OF SECTION

## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

### 1.2 SECTION INCLUDES

- A. Diffusers.
- B. Grilles and Registers.
- C. Louvers.

### 1.3 REFERENCES

- A. ADC 1062: GRD - Test Code for Grilles, Registers & Diffusers; Air Diffusion Council; 1984.
- B. ARI 890 - Standard for Air Diffusers and Air Diffuser Assemblies; Air-Conditioning and Refrigeration Institute; 2001.
- C. ASHRAE Std 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets; American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.; 2006.
- D. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

### 1.4 SUBMITTALS

- A. See Section 23 0050 for submittal procedures.
- B. Product Data: Contractor and Vendor to review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit product data, and schedule of outlets and inlets showing type, size, location, application, and noise level.

### 1.5 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.
- B. Test and rate louver performance in accordance with AMCA 500-L.

### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Diffusers, Registers, and Grilles:
  - 1. Carnes Company: [www.carnes.com](http://www.carnes.com).
  - 2. Krueger: [www.krueger-hvac.com](http://www.krueger-hvac.com).
  - 3. Price Industries: [www.price-hvac.com](http://www.price-hvac.com).
  - 4. Metalaire: [www.metalaire.com](http://www.metalaire.com).
  - 5. Titus: [www.titus-hvac.com](http://www.titus-hvac.com).
- B. Louvers:
  - 1. Carnes Company: [www.carnes.com](http://www.carnes.com)
  - 2. Greenheck Inc: [www.greenheck.com](http://www.greenheck.com)
  - 3. Ruskin Inc: [www.ruskin.com](http://www.ruskin.com)

## 2.2 GENERAL

- A. The manufacturer shall provide published performance data for the diffusers, registers and grilles. The performance data shall be derived from tests conducted in accordance with ASHRAE Std 70.
- B. See Diffusers, Grilles, and Registers Schedule on the Drawings.

## 2.3 LOUVERS

- A. See Louver Schedule on the Drawings. Schedule indicates minimum acceptable performance.
- B. Louvers shall be AMCA certified for air performance and water penetration.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- E. Paint ductwork visible behind air outlets and inlets, matte black finish color.

END OF SECTION

## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

### 1.2 SECTION INCLUDES

- A. Disposable, extended area pleated panel filters.

### 1.3 REFERENCES

- A. ASHRAE Std 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 1992.
- B. UL 900 - Standard for Air Filter Units; Underwriters Laboratories Inc.; 2004.

### 1.4 SUBMITTALS

- A. See Section 23 0050 for submittal procedures.
- B. Product Data: Provide data on filter media, filter performance data and filter frames.
- C. Operation and Maintenance Data: Include instructions for operation, changing, and periodic cleaning.

### 1.5 EXTRA MATERIALS

- A. Provide one spare set of disposable panel filters.

## PART 2 PRODUCTS

### 2.1 FILTER MANUFACTURERS

- A. American Filtration Inc: [www.americanfiltration.com](http://www.americanfiltration.com).
- B. AAF International/American Air Filter: [www.aafintl.com](http://www.aafintl.com).
- C. Camfil Farr Company: [www.camfilfarr.com](http://www.camfilfarr.com).

### 2.2 DISPOSABLE, EXTENDED AREA PLEATED PANEL FILTERS

- A. Manufacturer: Camfil Farr 30/30 or equal.
- B. Media: UL 900 Class 2, pleated, lofted, non-woven, reinforced cotton and synthetic fabric; supported and bonded to welded wire grid, with EPA registered and environmentally safe antimicrobial preservative.
  - 1. Frame: Cardboard.
  - 2. Nominal thickness: 2 inches.
- C. Rating, per ASHRAE Std 52.1:
  - 1. Dust spot efficiency: 25-30 percent.
  - 2. Weight arrestance: 90-92 percent.
  - 3. Initial resistance at 250 fpm face velocity: 0.08 inch WG.

### 2.3 FILTER FRAMES AND HOUSINGS

- A. General: Fabricate filter frames and supporting structures of 16 gage galvanized steel or extruded aluminum T-section construction with necessary gasketing between frames and walls. Filter access doors to include hinges, continuous gasketing, and positive locking devices.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. Install air cleaning devices in accordance with manufacturer's instructions.
- B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.
- C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.
- D. Deliver one extra set of air filters to Owner Representative.

END OF SECTION

## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

- A. Work of this Section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this Specification and accompanying Drawings.

### 1.2 SECTION INCLUDES

- A. Electric furnaces.
- B. Refrigerant cooling coils.
- C. Air cooled heat pump units.
- D. Controls.

### 1.3 RELATED SECTIONS

- A. Section 23 0548 - Vibration and Seismic Controls for HVAC Piping and Equipment.
- D. Section 23 3100 - HVAC Ducts and Casings.
- C. Section 23 3000 - Air Duct Accessories.
- D. Section 23 400 - Air Cleaning Devices.

### 1.4 REFERENCES

- A. ASHRAE Std 90.1 - Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2001.
- B. ASHRAE Std 90.2 - Energy-Efficient Design of New Low-Rise Residential Buildings; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2004.
- C. ASHRAE Std 103 - Methods of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 1993.
- D. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment; Air-Conditioning and Refrigeration Institute; 1994.
- E. ARI 270 - Sound Rating of Outdoor Unitary Equipment; Air-Conditioning and Refrigeration Institute; 1995.
- F. ARI 520 - Positive Displacement Condensing Units; Air-Conditioning and Refrigeration Institute; 1997.
- G. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems; National Fire Protection Association; 2002.
- H. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association; 2002.
- I. ASHRAE Std 15 - Safety Code for Mechanical Refrigeration; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 1994.
- J. ASHRAE Std 23 - Methods of Testing for Rating Positive Displacement Refrigerant Compressors and Condensing Units; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 1993.

## 1.5 SUBMITTALS

- A. See Section 23 0050 for submittal procedures.
- B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams. Indicate refrigerant pipe sizing.
- C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.
- D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- E. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

## 1.6 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.
- B. Unit efficiencies shall comply with the State of Oregon Energy Code requirements.

## 1.7 WARRANTY

- A. See Section 23 0050 for additional warranty requirements.
- B. Provide three year manufacturers warranty for control board.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Carrier Corporation; Model 58MVP: [www.carrier.com](http://www.carrier.com).
- B. Lennox Industries Inc.: [www.lennox.com](http://www.lennox.com)
- C. The Trane Company: [www.trane.com](http://www.trane.com).

### 2.2 ELECTRIC FURNACES

- A. Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating element, controls, air filter, humidifier, and accessories; wired for single power connection with control transformer.
  - 1. Air Flow Configuration: Upflow.
  - 2. Heating: Electric.
- B. Cabinet: Steel with baked enamel finish, easily removed and secured access doors, glass fiber insulation and reflective liner.
- C. Supply Fan: Centrifugal type rubber mounted with direct drive motor.
- D. Motor: 1750 rpm single speed.
- E. DX Coil: Provide DX coil as part of the package. See Schedule on Drawings for capacity.
- F. Electric Heater: Helix wound bare nichrome wire heating elements arranged in incremental stages with porcelain insulators.
- G. Electric Heater Operating Controls:
  - 1. Low voltage adjustable room thermostat energized heater stages in sequence with pre-determined delay between heating stages. See Thermostat Section below for more details.
  - 2. High limit temperature control de-energizes heating elements, automatic resets.



3. Supply fan starts before electric elements are energized and continues operating after thermostat is satisfied until bonnet temperature reaches minimum setting. Include manual switch for continuous fan operation.
4. Outdoor thermostat locks out some heating elements until outdoor temperature drops.
- H. Air Filters: 1 inch thick glass fiber, disposable type arranged for easy replacement. Refer to specification section 23 4000 HVAC Air Cleaning Devices.
- I. Performance:
  1. Refer to Fan Coil Unit Schedule on drawings.
- J. Operating Controls:
  1. Room Thermostat: Cycles burner to maintain room temperature setting. See Section below for details.

## 2.3 OUTDOOR UNITS

- A. Refer to schedule on Drawings for outdoor unit type and capacity.
- B. Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, with compressor and condenser.
- C. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
- D. Construction and Ratings: In accordance with ARI 210/240 with testing in accordance with ASHRAE Std 23 and UL listed.
- E. Compressor: hermetic, resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling.
- F. Air Cooled Condenser: Aluminum fins mechanically bonded to seamless copper tubing, with direct drive axial propeller fan resiliently mounted, galvanized fan guard. Seal with holding charge of refrigerant. Motors shall be weatherproof, suitable for outdoor use, single phase permanent split capacitor type, with permanent lubricated ball bearings, and built in thermal overload protection. Shafts shall be corrosion resistant.
- G. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gage ports, thermometer well (in liquid line).
  1. Provide thermostatic expansion valves.
  2. Provide heat pump reversing valves for heat pump units.
- H. Operating Controls:
  1. Control by room thermostat to maintain room temperature setting.
  2. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig and off when pressure drops below 140 psig for operation to 0 degrees F.
- I. See section 23 0548 for additional requirements.

## 2.4 Room Thermostat:

- A. Room Thermostat: Wall-mounted, electric solid state microcomputer based room thermostat with remote sensor to maintain temperature setting; low-voltage; with following features:
  1. Automatic switching from heating to cooling.
  2. For heat pumps, first stage of heating uses the heat pump, second stage of heating uses the electric resistance heat in incremental stages.
  3. Preferential rate control to minimize overshoot and deviation from setpoint.
  4. Short cycle protection.
  5. Programming based on every day of the week.

6. Selection features including degree F or degree C display, 12 or 24 hour clock, keyboard disable, remote sensor, fan on-auto.
7. Battery replacement without program loss.
8. Thermostat display:
  - a. Actual room temperature.
  - b. Programmed temperature.
  - c. System mode indication: heating, cooling, fan auto, off, and on, auto or on, off.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.
- B. Verify that proper power supply is available and in correct location.

#### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.
- B. Install in accordance with NFPA 90A and NFPA 90B.
- C. Install refrigeration systems in accordance with ASHRAE Std 15.

END OF SECTION





## PART 1 GENERAL

### 1.1 WORK INCLUDED

- A. Section specifies a Fire Alarm System (FAS) including initiation, notification, control and power equipment, cable, connectors, and associated equipment and material.
- B. Related Sections:
  - 1. Division 21, 22, 23, 24 and 25
  - 2. Division 26 - Section 26 00 01, 26 27 26, 26 05 33, 26 05 53, 26 05 19, 26 05 26

### 1.2 DEFINITION

- A. Alarm Signal: Signifies state of emergency requiring immediate action. Pertains to signals such as operation of manual station and operation of sprinkler system water flow switch.
- B. Authority Having Jurisdiction (AHJ): The "AHJ" is the organization, office, or individual responsible for approving equipment, installation, or procedure.
- C. Class A Wiring: Circuits arranged and electrically supervised such that a single break or a single non-simultaneous ground fault condition on a circuit conductor indicates a trouble signal at the fire alarm control panel (FACP), and the circuit continues to be capable of operation for its intended service in the faulted condition no matter where the break or ground fault condition occurs.
- D. Class B Wiring: Circuits electrically supervised such that a single break or a single non-simultaneous ground fault condition on a circuit conductor indicates a trouble signal at the FACP no matter where the break or ground fault condition occurs. Circuits are not capable of transmitting an alarm signal beyond the fault location.
- E. Initiating Device: An FAS component that originates transmission of a change of state condition, such as manual stations, smoke detectors, heat detectors, or sprinkler system water-flow and tamper switches.
- F. "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
- G. Multiplex System: A system using a signaling method characterized by the simultaneous or sequential transmission, or both, and the reception of multiple signals in a communication channel, including means for positively identifying each signal.
- H. Notification Appliance: An FAS component such as a bell, horn, speaker, strobe light, etc. that provides an audible or visible output or both.
- I. Style: Initiating device, notification appliance, or signaling line circuit designation by the circuits' ability to transmit alarm and trouble signals during specified simultaneous multiple circuit fault conditions, in addition to the single circuit fault conditions considered in the designations of the circuits by class.
- J. Supervisory Signal: Indicates abnormal status or need for action regarding fire suppression or other protective systems.
- K. Trouble Signal: Indicates that a fault, such as an open circuit, ground, power supply, communications, or other trouble has occurred on the system.

- L. Zone: Initiating device or combination of devices connected to a single alarm-initiating device circuit or programmed to report (addressable devices) as a single circuit.

### 1.3 SYSTEM DESCRIPTION

- A. General: Provide complete, addressable, non-coded, multiplex, microprocessor-based fire detection and alarm system.
- B. Alarm Initiation: By individually addressable, automatically or manually operated devices.
- C. Local Alarm Notification - Audible: Automatic by sounding of notification appliances (horns) throughout the building(s).
- D. Local Alarm Notification - Visible: Automatic by lighting of notification appliances (Xenon type strobe lights) throughout the building(s).
- E. Remote Alarm Notification: Provisions for alarm signal transmission to a local remote display/annunciator.
- F. Central Station Notification: Provisions for alarm signal transmission to a UL Listed alarm monitoring service.
- G. Functional Description: Include following system functions and operating features plus additional functions and features required by the Local Authority Having Jurisdiction:
  - 1. Fully field configurable and programmable system. (The use of batteries or battery backup for the programming function is not acceptable).
  - 2. Priority of Signals: Accomplish automatic response functions by first zone and/or device initiated. Alarm functions resulting from initiation by first zone are not altered by subsequent alarms. Highest priority is alarm signal. Supervisory and trouble signals have second and third level priority. Higher-priority signals take precedence over signals of lower priority, even though lower-priority condition occurred first. Annunciate all alarm signals regardless of priority or order received.
  - 3. Non-interfering: Zone, power, wire, and supervise the system so a signal on one zone does not prevent the receipt of signals from any other zone. All zones are manually resettable after the initiating device or devices are restored to normal.
  - 4. Silencing Alarm, Supervisory and Trouble Conditions: Switches provide capability for acknowledgment of alarm, supervisory, trouble, and other specified signals at FACP and capability to silence local audible signal and light a light-emitting diode (LED). Acknowledge pending alarms prior to silencing the audible signal. Silencing the audible notification appliances must not automatically turn off the visible appliances. Subsequent zone alarms cause audible signal to sound again until silenced by switch operation. Restoring alarm, supervisory, and trouble conditions to normal extinguishes associated LED and causes audible signal to sound again until restoration is acknowledged by switch operation.
  - 5. Loss of primary power sounds trouble signal at FACP and remote display/annunciator. Indicate when fire alarm system is operating on alternate power supply.
  - 6. Annunciation: Manual and automatic operation of alarm and supervisory-initiating devices annunciates the following:
    - a. FACP LCD:
      - i) 32-character custom message
      - ii) Identify device type
      - iii) Devices Status (i.e. Alarm, Supervisory, Trouble)
      - iv) Time and Date

7. FACP Annunciator: Display plain-English-language descriptions and addresses of initiating devices, alarms, trouble signals, supervisory signals, monitoring actions, system and component status, and system commands.
  8. See the fire alarm system matrices for required system functions:
  9. Trouble-Shooting, Maintenance, and Diagnostics:
    - a. Automatic identification at the FACP and at the remote display/annunciator of any analog sensor, which becomes dirty prior to false alarming.
    - b. Automatic and manual adjustment of analog sensor sensitivity (up or down). Adjustable by time of day.
  10. FACP Primary Power Supply: Primary power to be supplied in accordance with NFPA 70.
- H. Recording of Events: Record alarm, supervisory, and trouble events to FACP history buffer. Recordings are by zone, device, and function. When FACP receives a signal, alarm, supervisory, and trouble conditions are recorded. The recording includes the type of signal, zone identification, date, and the time of occurrence. The recording differentiates alarm signals from all other recorded indications. When system is reset, this event is also recorded, including same information for device, location, date, and time. A menu command initiates a printout of a list of existing alarm, supervisory, and trouble conditions in system when a printer is attached.
1. Provide a total capacity of 500 events, allowing, "first in, first out" memory.
  2. Provide RS-232 port on each FACP suitable for a printer attachment.
- I. Permissible Signal Time Elapse: Maximum permissible elapsed time between actuation of alarm or fire-detection system alarm-initiating device and indication at FACP is 5 seconds.
- J. Independent System Monitoring: Supervise each independent smoke or heat detection system, duct detector, and elevator smoke-detection system for both normal operation and trouble.
- K. Circuit Supervision: Indicate circuit faults by both zone and trouble signal at the FACP. Provide distinctive indicating audible zone and LED-indicating light. Maximum permissible elapsed time between occurrence of trouble condition and indication at FACP is 200 seconds.
- L. Communications: Provide equipment suitable for transmission of signals over copper cable.
- M. Provide and install conduit, cable, raceways, and accessories to power and interconnect FAS equipment. Meet requirements specified in Division 26, 27 and 28 - Electrical. Meet local code requirements and established industry standards for installation of conduit and raceways.
- 1.4 SUBMITTALS
- A. Initial submittal shall consist of:
1. Product data for system components. Include dimensioned plans and elevations showing minimum clearances and installed devices and configuration. Include list of materials and Nationally Registered Testing Laboratory (NRTL) listing data.
  2. Wiring diagrams from manufacturer differentiating between factory- and field-installed wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Indicate components for both field and factory wiring.

3. System cable types including sizes, dimensions and characteristics based on voltage drop and signal loss calculations.
  4. System operation description covering this specific project including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
  5. Voltage drop calculations for Notification Appliance Circuits and other low voltage control circuits.
  6. Battery calculations for all power supplies requiring battery backup.
  7. Complete and expanded functional matrix noting input/output addresses, and "custom messages". Provide in Microsoft Excel format. Make available in hard copy and 3.5" CD disk copy.
  8. Complete single-line riser diagram noting all devices with circuit/device address and associated room number.
  9. Floor plans with all necessary notations, clarifications, and noting all devices with circuit/device address and associated room number and description.
    - a. Include ceiling type and height.
    - b. Include raceway type being utilized as approved in Section 26110.
  10. Circuit labeling scheme differentiating between circuit types.
- B. Provide Operations and Maintenance manuals for all devices and/or products
- C. Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the AHJ. Include copies of annotated Contract Drawings as required to depict component locations to facilitate review. Upon receipt of comments from the AHJ, submit them to the Owner for review. Resubmit if required to make clarifications or revisions to obtain approval.
- D. Test Procedures: Submit test procedures for system acceptance test.
1. Develop test procedures to confirm that each specification requirement is met or exceeded.
  2. Provide Alarm Test Procedure (ATP) based upon complete functional matrix. Provide space for AHJ and Owner's (or their designated representative) to "sign off" per each device.
- E. Certifications: Provide evidence of personnel qualifications and certifications. Provide personnel licensed as required by state law.
1. Requirements:
    - a. Installation foreman shall be Oregon licensed low voltage journeyman.
    - b. Installation crew shall be minimum Oregon licensed low voltage apprentices.
    - c. Vendor project manager shall be certified NICET Level III.
    - d. Vendor technician performing system programming, start-up, and testing shall be NICET Level II, and factory certified on system being supplied.
    - e. Organization chart for project.
- F. Record Drawings: Provide drawings showing equipment installed, cable identifiers, and schedules. Record drawings shall be "CAD" version (AutoCAD 2002) of "redlined" drawings maintained on project site".
1. Include NFPA 72 Certificate of Completion for each site.



- G. Sequence and Scheduling Plan: Provide Gantt chart schedule for design and installation within 30 days of award.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Factory-authorized. Minimum of five years experience in the design, installation, and maintenance of industrial fire alarm systems.
- B. Compliance With Local Requirements: Comply with the current and applicable building code, local ordinances and regulations, and the requirements of the AHJ.
  - 1. Oregon Structural Specialty Code
  - 2. International Fire Code Uniform Fire Code w/Oregon Amendments
  - 3. Oregon Mechanical Code
- C. Comply with requirements of the Americans With Disabilities Act (ADA).
- D. NRTL Listing: Provide systems and equipment that are "Listed and Labeled."
- E. Single-Source Responsibility: Each item of Fire Alarm System is listed as a product of a single fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and bears the UL label. Control equipment is listed under UL category UOJZ.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturers' requirements. Coordinate storage location(s) with Owner's on site personnel.

#### 1.7 FIELD INVESTIGATION

- A. Survey property where Work is to be performed to identify utilities and services where Work is to be coordinated prior to bid. Final equipment locations to be coordinated with and approved by Owner and AHJ prior to installation.
- B. Lack of survey by the awarded contractor/vendor team shall not relieve them of the responsibility to provide a complete and operational system.

#### 1.8 SCHEDULING

- A. Schedule and coordinate installation with General Contractor's personnel.

#### 1.9 POST-CONTRACT INSPECTION

- A. Conduct post-contract inspection with Owner-designated representative(s) to ensure that punch list items have been remedied and that systems are functioning as designed.

#### 1.10 WARRANTY

- A. Labor:
  - 1. Warrant all labor associated with each system installation for one (1) year after owner's acceptance of the system.
  - 2. Should the system or system components fail to perform, during the one (1) year warranty period, and according to terms of warranty, the contractor/vendor shall repair or replace system or components at no charge to the Owner and with a minimum delay.

B. Equipment and Components:

1. Warrant all hardware and software against faulty or inadequate design, improper assembly, defective workmanship or materials, breakage, or other failure for one (1) year after owner's acceptance of the system.
2. The minimum warranty period shall be one (1) year, however; each contractor/vendor should clearly indicate the maximum equipment and device warranty which is available at no additional charge.
3. Provide software upgrades and revisions for all components at no charge to the Owner during the initial on (1) year warranty.

1.11 SCOPE OF WORK

- A. The scope of work for this project consists of one (1) building. It shall be the contractor's responsibility to familiarize him/herself with the specific nature of each site.
- B. Appropriate "open" cabling shall be permitted above accessible ceilings only.
- C. All exposed wiring and surface mounted devices shall be in EMT, minimum 3/4" in size. All surface mounted horn/strobes, strobes and manual pull stations shall be mounted, on the manufacturer's supplied surface box, to create a neat and workmanlike appearance.
- D. The following is the general outline of activities and events required with this scope of work.
1. Initial submittal as noted in 1.04A, 1 – 10 above within 60 days of award.
  2. Provide simultaneous submission to AHJ.
  3. Alarm Test Procedures as noted in 1.04.D 30 days prior to initial system startup.
  4. Provide AHJ and Owner Acceptance Testing schedule 30 days prior to commencing site test.
  5. Provide site staff training 48 hours after acceptance by AHJ and Owner. Incorporate as part of schedule noted in item 1.11.D.4.
  6. Record drawings and Operations and Maintenance Manuals shall be furnished with 30 days of Owner acceptance.

PART 2 – PRODUCTS

2.1 VENDORS

- A. Manufacturer: Siemens, Edwards and Notifier are approved.
- B. The following are the minimum requirements for installation of the fire alarm system.
1. Signal Line Circuit: Provide 20% spare device capacity when installation is complete.
  2. Notification Appliance Circuit: Provide 20% additional capacity for current consumption and length of circuit (per NAC) when installation is complete.
  3. Power Supply: Provide 20% spare power.
    - a. Batteries: Provide 20% spare battery power.

2.2 EQUIPMENT/COMPONENTS

- A. Provide equipment, conduit, and wire as required to provide a complete and operational fire alarm system. Equipment is to be standard, unmodified, "off-the-shelf" products designed for uninterrupted duty. Where types are not indicated, provide products complying with established industry standards. Wire and cable has applicable National Electrical Code (NEC) rating for area in which it is to be installed (e.g., FPLP for plenum areas).

## 2.3 FIRE ALARM CONTROL PANEL

- A. General: Comply with UL 864, 9<sup>th</sup> Edition.
- B. Cabinet: Lockable steel enclosure. Arrange panel so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control panel, provide exactly matching modular unit enclosures. Accommodate all components and allow ample gutter space for interconnection of panels and field wiring. Identify each enclosure by an engraved, red, laminated, phenolic-resin nameplate. Lettering on the enclosure's nameplate shall not be less than 1 inch (25 mm) high. Identify individual components and modules within the cabinets with permanent labels.
- C. Systems: The module circuit boards in the FACP consist of plug-in cards. Construction requiring removal of field wiring for module replacement is unacceptable.
- D. Control Modules: Provide types and capacities required to perform all functions of the fire alarm systems. Local, visible, and audible signals announce alarm, supervisory, and trouble conditions.
- E. Zones/Addresses: Provide for sufficient alarm and supervisory zones/addresses.
- F. Resetting: Provide necessary controls to prevent the resetting of any alarm, supervisory, or trouble signal while the alarm or trouble condition still exists.
- G. Alphanumeric Display and System Controls: Arrange to provide the basic interface between human operator at the FACP and addressable system components, including annunciation and supervision. Provide a display with a minimum of 32 characters to show alarm, supervisory, and component status messages. Arrange keypad for use in entering and executing control commands.
- H. Instructions: Printed or typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame. Install frame in a location observable from the FACP. Include interpretation and appropriate response for displays and signals, and briefly describe the functional operation of the system under normal, alarm, and trouble conditions.
- I. Sensitivity: Provide sensitivity testing capability at the fire alarm control panel to test the smoke detectors in the entire building.

## 2.4 EMERGENCY POWER SUPPLY

- A. General: Components include sealed lead acid-type battery, charger, and an automatic transfer switch. Battery nominal life expectancy is 5 years, minimum.
- B. Battery capacity is adequate to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24-hours. At the end of this period, the battery has sufficient capacity to operate the system, including alarm-indicating devices in either alarm or supervisory mode, for a period of 5 minutes. (Magnetic door holders are not served by emergency power. Magnetic door holders are released when normal power fails.) Battery Charger: Solid-state, fully automatic, variable-charging-rate type. Provide capacity for 150 percent of the connected system load while maintaining the batteries at full charge. In the event batteries are fully discharged, the charger recharges them to 75% capacity within 12 hours. Charger output is supervised as part of system power supply supervision.
- C. Integral Automatic Transfer Switch: Transfers the load to the battery without loss of signals or status indications when normal power fails.

## 2.5 ANNUNCIATION

- A. Provide an LED, Directory type annunciator.
  - 1. The annunciator shall communicate with the FACP via a Signal Line Circuit (SLC). The SLC shall be a RS-485 type of circuit. Addressable device loops are not deemed satisfactory.
- B. An LCD annunciator which can "vector" the required information noted above may be used in lieu of LED annunciator.

## 2.6 SERIAL DIGITAL COMMUNICATOR

- A. Provide manufacturer's standard serial interface digital communicator:
  - 1. RS-232 interface to FACP.
  - 2. Transmission of device ID with custom message and device status.
  - 3. U.L Listed

## 2.7 ADDRESSABLE DEVICES

- A. Alarm-Initiating Devices: Classified as addressable devices according to NFPA 72.
  - 1. Communication Transmitter and Receiver: Integral to device. Provides each device with a unique identification and capability for status reporting to the FACP.
  - 2. External Addressable Interface Unit: May be used where specified devices are not manufactured and labeled with integral multiplex transmitter and receiver. Arrange to monitor status of each device individually.

## 2.8 MANUAL PULL STATIONS

- A. Description: Single-action type, fabricated of metal or plastic, and finished in red with molded, raised letter operating instructions in white.
  - 1. Station Reset: Key (same as FACP) reset. Station to have integral addressable module. Stations have screw terminals for connections.
  - 2. Provide with Plexiglas cover. Cover by STI or equal.

## 2.9 INTERFACE MODULES

- A. Provide interface module for monitoring dry contact inputs such as flow and tamper switches, hood systems, and other related devices. Class "B" initiating device circuits.
- B. Device may be single or dual input as necessary.

## 2.10 CONTROL MODULE

- A. Provide control module for control of circuits as indicated on required. Provide Form "C", 4 ampere rated @ 120VAC or 24VDC. Provide interposing relay as indicated on the required.

## 2.11 SMOKE DETECTORS

- A. General: Comply with UL 268. Include the following features:
  - 1. Factory Nameplate: Serial number and type identification.
  - 2. Operating Voltage: 24-VDC, nominal.

3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
  4. Plug-in Arrangement: Detector and associated encapsulated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. The plug connection requires no springs for secure mounting and contact maintenance. Terminals in the fixed base accept building wiring.
  5. Integral Visual Indicating Light: Connect to indicate detector has operated.
  6. Remote Controllability: Individually monitor detectors at the FACP for calibration, sensitivity, and alarm condition, and individually adjust for sensitivity from the FACP.
- B. Photo-electronic Smoke Detectors: Include the following features:
1. Detector Sensitivity: Between 2.5 and 3.5 percent-per-foot (0.008-0.011-percent-per-mm) smoke obscuration when tested according to UL 268.
  2. Sensor: An infrared detector light source with matching silicon-cell receiver. Provide integral thermistor set for 135 degrees Fahrenheit, rate compensated.
  3. Provide audible base as required. Base shall provide 85dBA @ 10 feet. Provide operation as indicated in functional matrix.
  4. Provide the following devices in the indicated locations:
    - a. Standard addressable photoelectric detector.

## 2.12 ALARM-INDICATING DEVICES

- A. Provide audio/visual devices with temporal (Code 3) audible signal and synchronized strobes.
- B. The notification appliances shall be Wheelock Series AS Multi-Candela Audible Strobe appliances and Series AH Audible appliances or equal.
1. The Series AS Multi-Candela shall meet and be listed for UL Standard 1971 (Emergency Devices for the Hearing-Impaired) for Indoor Fire Protection Service.
  2. The Series AH Audible shall be UL Listed under Standard 464 (Fire Protective Signaling).
  3. Device characteristics:
    - a. All inputs shall be compatible with standard reverse polarity supervision of circuit wiring by a Fire Alarm Control Panel (FACP).
    - b. The audible portion of the appliance shall have a minimum of three (3) field selectable settings for dBA levels and shall have a choice of continuous or temporal (Code 3) audible outputs.
    - c. The strobe portion of the appliance shall produce a flash rate of one (1) flash per second over the listed Regulated Input Voltage Range of 16 to 33 VDC for 24-VDC models and shall incorporate a Xenon flashtube enclosed in a rugged Lexan(r) lens.
    - d. The Series AS Multi-Candela(r) shall be of low current design and shall have Zero Inrush.
    - e. The strobe intensity shall have a minimum of four (4) field selectable settings and shall be rated per UL 1971 for: 15, 30, 75 or 110 candela (wall mount versions).
    - f. The audible and audible strobe shall be designed for 24 VDC, 2-Wire operation and, when synchronization is required, shall be compatible with Wheelock's SM, DSM Sync Modules or Wheelock's PS-12/24-8 Power Supply with built-in Patented Sync Protocol.
    - g. The strobes shall not drift out of synchronization at any time during operation.
    - h. If the sync module or Power Supply fails to operate, (i.e., contacts remain closed), the strobe shall revert to a non-synchronized flash-rate.

- i. The appliance shall also be designed so that the audible signal may be silenced while maintaining strobe activation (when used with the Wheelock Sync Module, Dual Sync Module or Wheelock Power Supply).
- 4. Mounting:
  - a. The Series AS Multi-Candela(r) Audible Strobe and Series AH Audible shall incorporate a Patented Universal Mounting Plate that shall allow mounting to a single-gang, double-gang, 4-inch square, 100mm European type back boxes, or the SHBB Surface Back box.
  - b. If required, an NATP (Notification Appliance Trim plate) shall be provided. All notification appliances shall be backward compatible.
- C. Strobes: The visual notification appliances shall be Wheelock Series RSS Multi-Candela Strobe Appliances or approved equals.
  - 1. The Series RSS Multi-Candela shall meet and be listed for UL Standard 1971 (Emergency Devices for the Hearing-Impaired) for Indoor Fire Protection Service
  - 2. The strobe shall be listed for indoor use and shall meet the requirements of FCC Part 15 Class B.
  - 3. Device characteristics:
    - a. All inputs shall be compatible with standard reverse polarity supervision of circuit wiring by a Fire Alarm Control Panel (FACP).
    - b. The strobe portion of the appliance shall produce a flash rate of one (1) flash per second over the listed Regulated Input Voltage Range of 16 to 33 VDC for 24-VDC models and shall incorporate a Xenon flashtube enclosed in a rugged Lexan(r) lens.
    - c. The Series RSS Multi-Candela(r) shall be of low current design and shall have Zero Inrush.
    - d. The strobe intensity shall have a minimum of four (4) field selectable settings and shall be rated per UL 1971 for: 15, 30, 75 or 110 candela (wall mount versions).
    - e. The strobe shall be designed for 24 VDC, 2-Wire operation and, when synchronization is required, shall be compatible with Wheelock's SM, DSM Sync Modules or Wheelock's PS-12/24-8 Power Supply with built-in Patented Sync Protocol.
    - f. The strobes shall not drift out of synchronization at any time during operation.
    - g. If the sync module or Power Supply fails to operate, (i.e., contacts remain closed), the strobe shall revert to a non-synchronized flash-rate.
    - h. The appliance shall also be designed so that audible signals on the NAC may be silenced while maintaining strobe activation (when used with the Wheelock Sync Module, Dual Sync Module or Wheelock Power Supply).
  - 4. Mounting:
    - a. The strobes shall be designed for indoor surface of flush mounting
    - b. The Series RSS Multi-Candela(r) Strobe and Series AH Audible shall incorporate a Patented Universal Mounting Plate that shall allow mounting to a single-gang, double-gang, 4-inch square, 100mm European type back boxes, or the SHBB Surface Back box.
    - c. If required, an NATP (Notification Appliance Trim plate) shall be provided.
    - d. An attaching cover plate shall be provided to give the Appliance and attractive appearance. The Appliance shall not have any mounting holes or screw heads visible when the installation is completed.

D. Weather Proof Horn and Strobe:

1. Provide Wheelock model W3MT-24R weatherproof strobe or equal.
2. Provide Wheelock model AH-24WP weatherproof horn or equal.
3. Mount both devices to manufacturer's weatherproof box (WBB-R).

E. Synchronization Modules:

1. The sync modules shall be Wheelock Series SM or DSM Sync Modules, or equal.
2. Series SM or DSM Sync Modules shall be the master controllers for Wheelock Series AS/AH, NS/NS4/NH, RSS, RSSP, SL, SLM appliances where a synchronized audible/visual audible or visual only appliance is specified.
3. All modules shall be UL listed under Standard 464. Series SM and DSM modules shall be designed to interface with Series AS Audible Strobe Appliances and NS Horn Strobe Appliances to produce a synchronized temporal (Code 3) horn as well as synchronized strobe flash on a two-wire alarm circuit.
4. Other synchronized products are the Wheelock Series RSS, RSSP, SL, SLM visual only appliances and Series AH and NH Horn Appliances.
5. SM Sync Module shall incorporate two input NAC circuits for power connection from the Fire Alarm Control Panel: one for the strobe NAC circuit and one for the audible NAC circuit.
6. DSM modules shall provide an additional strobe circuit input/output for control of either two Class "B" NAC circuits or a single Class "A" NAC circuit.
7. Operation:
  - a. Upon activation of the audible silence function at the Fire Alarm Control Panel, the audible signal component of Series AS Audible Strobe and/or the Series NS Horn Strobe may be silenced while maintaining strobe activation.
  - b. The DSM dual circuit version shall provide the additional capability of "daisy-chaining", that is, the ability to interconnect multiple DSM's for synchronous horn and strobe operation on multiple NAC circuits.
  - c. Interconnection capability shall be for a maximum of 40 NAC circuits.
8. Voltages:
  - a. All modules shall operate on either 12 or 24 VDC.
  - b. Rated average current requirement for the SM 12/24 shall be .014 amperes @ 12 VDC and .025 amperes @ 24 VDC.
  - c. The DSM 12/24 shall be .020 amperes @ 12 VDC and .038 amperes @ 24 VDC.
  - d. A single circuit SM Sync Module shall be capable of handling a 3-ampere load at 12 or 24 VDC and the dual circuit DSM Sync Module shall be capable of handling a load of 3 amperes per NAC circuit at 12 or 24 VDC.
  - e. All versions shall be polarized for DC supervision and shall incorporate screw terminals for in/out field wiring of #18 to #12 AWG wire size.
9. Mounting:
  - a. SM module shall mount to a standard 4" x 2-1/8" deep back box.
  - b. DSM module shall mount to a 4-11/16" x 2-1/8" deep back box. (Wheelock DSM)

## 2.13 MISCELLANEOUS

- A. Line-Voltage and Low-Voltage Wire and Cable: Provide copper cable in sizes and types as recommended by equipment manufacturer for indicated applications. Use solid copper conductors. Sizes and types based on load voltage drop and line loss calculations provided by manufacturer. Provide cable that meets or exceeds the appropriate requirement for the areas in which it is installed. Outer jacket to be continuous, free from holes, splits, and inclusions.
- B. AC Surge Protection: Provide lightning/surge protection devices for all AC powered components. Comply with UL 96, 96A, 497, 497A, 497B, and 1449. Transtector or equal as approved manufacturer.
- C. Low Voltage Surge Protection: Provide lightning/surge protection devices for all "low voltage" powered circuits as they "leave" and "enter" a building. Comply with NEC and applicable UL Listings. Transtector or equal as approved manufacturer.
- D. Tags For Identifying Tested Components: Comply with NFPA 72.
- E. Wire Labeling: Provide Panduit laser tags or equal. Each panel connection and device connection to indicate either its preceding origination point, or its destination point. Provide labeling scheme with submittals.

## 2.14 ACCESSORIES

- A. Provide hardware, software, cables, adapters, terminators, and other products as needed for a fully functional Fire Alarm System.

## PART 3 – EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Install system according to IFC 10-2 Standard, NEC, and other applicable standards.
- B. Ensure that:
  - 1. Applicable statutes, ordinances, regulations, license requirements and codes are fully complied with.
  - 2. Required permits are obtained.
  - 3. Required inspections are conducted.
  - 4. Necessary certificates are issued, obtained, and delivered to Owner.
- C. Arrange components to be mounted to provide a neat appearance and accessibility for servicing equipment.
- D. Program system per the requirements of this specification, the functional matrices, and local code requirements.

### 3.2 EQUIPMENT INSTALLATION

- A. Fire Alarm Power Supply Disconnect: Paint red and label "FIRE ALARM CIRCUIT CONTROL." Provide with lockable handle or cover.
- B. Fire Alarm Control Panel and Annunciators: Label requirements of Division 26. Mount with top at 60 inches above the finished floor.



- C. Manual Pull Stations: Mount semi-flush in recessed back boxes with operating handles mounted 48 inches above the finished floor. Locate in accordance with ADA requirements.
- D. Smoke Detectors: Install ceiling-mounted detectors not less than four inches from a sidewall to the near edge. Install detectors located on the wall at least four inches but not more than 12 inches below the ceiling. On smooth ceilings, install detectors not over 30 feet apart in any direction. Install detectors no closer than five feet from air registers.
- E. Audible/Visible Alarm-Indicating Devices: Install 80-inches above the highest floor level within the space or 6 inches below the ceiling, whichever is lower. Combine audible and visible alarms at the same location into a single unit.
- F. Visible Alarm-Indicating Devices: Install 80-inches above the highest floor level within the space or six inches below the ceiling, whichever is lower.
- G. Monitor and Control Modules: Mount devices so that they will be accessible for maintenance. Provide junction box as appropriate for configuration. Interposing relays shall be in the same enclosure as the control module.

### 3.3 WIRING INSTALLATION

- A. Provide panel wiring required, including temporary wiring. Install wiring according to NEC and National Fire Protection Association regulations (as applicable), and local building codes and ordinances. Obtain and adhere to referenced regulations, codes, ordinances, and standards. Label conductors as noted in Part I of this section.
- B. Install wiring in metal raceway, except where plastic conduit is approved for underground applications. Conceal raceway except in unfinished spaces and as indicated. Utilize in/out-wiring method for initiating and notification circuits.
- C. Install cable continuous and unspliced from origination to destination. Ensure cable distance limitations are not exceeded and that cable is sized and rated for appropriate application.
- D. Wiring Within Enclosures: Install conductors parallel with or at right angles to the sides and back of the enclosure. Bundle, lace, and train the conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the wiring diagrams of the system. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- E. Connect distribution and connector panel ground terminals to grounding terminals on each piece of equipment by a separate ground wire. Run ground wire from panel ground terminal to nearest building or distribution ground system. Grounding shall be as indicated on the manufacturer's shop drawings.
- F. Cable Taps: Use numbered terminal strips in junction, pull or outlet boxes, cabinets, or equipment enclosures where any circuit tap is made. Terminal strip connection points shall not have more than two (2) conductors under each screw terminal.
- G. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Paint fire alarm system junction boxes and covers red. Label covers of junction boxes "FA".

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.
- B. Testing:
  - 1. Assemble Alarm Test Procedure (ATP) for use in pre-testing.
  - 2. Base ATP on format of Functional Matrix, and the requirements of NFPA 72.
- C. Pre-testing:
  - 1. Upon completing installation of the system, align, adjust, and balance the system and perform complete pre-testing.
  - 2. Determine, through pretesting, the conformance of the system to the requirements of the Functional Matrix and Specifications.
  - 3. Correct deficiencies observed in pre-testing.
  - 4. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.
  - 5. Minimum required tests:
    - a. Verify the absence of unwanted voltages between circuit conductors and ground.
    - b. Test all conductors for short circuits utilizing an insulation-testing device.
    - c. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on the pretest report.
    - d. Verify the control unit is in the normal condition as detailed in the manufacturer's operating and maintenance manual.
    - e. Test initiating and indicating circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than ten percent of the initiating and indicating devices. Observe proper signal transmission according to class of wiring used.
    - f. Test each initiating and indicating device for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.
    - g. Test the system for all specified functions according to the manufacturer's operating and maintenance manual.
      - i) Systematically initiate specified functional performance items at each device including making all possible alarm and monitoring initiations and using all communications options.
      - ii) For each item, observe related performance at all devices, as they are required to be affected by the input item under all system sequences.
      - iii) Observe indicating lights, displays, signal tones, and annunciator indications.
    - h. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the period and in the manner specified.
  - 6. Tag all equipment, stations, and other components at which tests have been satisfactorily completed.

D. Report of Pre-testing:

1. After pre-testing is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of the witnesses to the pre-testing.
2. Attach documentation of pretest results.

E. Final Test Notice: Provide 10-day minimum notice to the Owner in writing when system is ready for final acceptance testing.

F. Final Test and Inspection:

1. Test per requirements of AHJ.
2. Owner and/or Owner's Representative shall conduct a 100% functional test of the system to ensure all conditions are in compliance with Functional Matrix and Specifications.

G. Retesting:

1. Should the system not meet satisfactory approval of either the AHJ or the Owner (or the Owner's designated Representative), and retest be determined to be necessary, then the contractor/vendor shall bear all applicable cost such as transportation, lodging, and per diems.
2. Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

H. Report of Final Test and Inspection:

1. Provide the following within 30-days of Owner Acceptance.
  - a. Provide a written record of inspections, tests, and detailed test results in the form of the original ATP.
  - b. Submit completed NFPA 72 Certificate of Completion.
  - c. Provide record drawings
  - d. Provide Operation and Maintenance manuals.

3.5 CLEANING AND ADJUSTING

- A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.
- B. Clean smoke detectors internally, as required, using methods and materials recommended by manufacturer.

3.6 SYSTEM SERVICING

- A. Provide Owner with pricing for a one (1) year Inspection and Test Agreement for the facilities. Furnish pricing and a copy of agreement 30 days prior to Owner Acceptance Testing. Inspection and Test to be based upon standards published in the Oregon International Uniform Fire Code, Article 10-2.
- B. Provide Owner with pricing for a one (1) year U.L. Listed central station monitoring agreement. Furnish pricing and a copy of agreement 30 days prior to Owner Acceptance Testing.

### 3.7 TRAINING

- A. Provide services of a factory-authorized service representative to demonstrate system and train Owner's staff personnel as specified below

1. Train Owner's personnel in the procedures involved in operating the system within 48 hours of owner acceptance.
2. Provide minimum of 2 hours training. Schedule training in conjunction with Owner Acceptance Testing.
3. The object of training is the following:

Familiarization of System Operation for:
Alarm and the definition of an alarm condition.
Provide an overview of what alarm initiating devices are furnished with the system
Supervisory, and the definition of a supervisory condition
Trouble, and the definition of a trouble condition
Provide an explanation as to the operation of the audio/visual devices

4. Provide a syllabus of training when submitting schedule for Final Acceptance Testing.
5. Provide a letter stating, within seven (7) days following the training, indicating who attended, the time and date that the training occurred, and signed by the site manager.

END OF SECTION